

HAWAIIAN SUGAR MANUAL 1987

HD9104
H39
1987

HSPA Hawaiian
Sugar
Planters'
Association



HAWAIIAN SUGAR COMPANIES
(Listed according to principal owners)

ALEXANDER & BALDWIN, INC.

HAWAIIAN COMMERCIAL & SUGAR CO.
R. F. Cameron, Gen. Mgr.
P. O. Box 266
Puunene, Hawaii 96784
Phone: 877-0081

McBRYDE SUGAR CO., LTD.
D. P. Scott, Vice Pres. & Gen. Mgr.
P. O. Box 8
Eleele, Hawaii 96705
Phone: 335-5333

AMFAC, INC.

KEKAHA SUGAR CO., LTD.
L. A. Faye, Jr., Pres. & Mgr.
P. O. Box 549
Kekaha, Hawaii 96752
Phone: 337-1472

THE LIHUE PLANTATION CO., LTD.
M. H. Furukawa, Pres. & Mgr.
P. O. Box 751
Lihue, Hawaii 96766
Phone: 245-2112

OAHU SUGAR CO., LTD.
W. D. Balfour, Jr., Pres. & Mgr.
P. O. Box 0
Waipahu, Hawaii 96797
Phone: 677-3577

PIONEER MILL CO., LTD.
J. C. Hance, Pres. & Mgr.
P. O. Box 727
Lahaina, Hawaii 96761
Phone: 661-0592

C. BREWER AND CO., LTD.

HILO COAST PROCESSING CO.^a
E. A. Kennett, Pres. & C.E.O.
P. O. Box 18
Pepeekeo, Hawaii 96783
Phone: 963-5516
964551

KA'U AGRIBUSINESS CO., INC.
R. B. Cushnie, President
P. O. Box 130
Pahala, Hawaii 96777
Phone: 928-8311

MAUNA KEA AGRIBUSINESS CO., INC.^b
J. A. Sasan, Vice Pres. & Mgr.
P. O. Box 68
Papaikou, Hawaii 96781
Phone: 964-1025

OLOKELE SUGAR CO., LTD.
D. B. Cataluna, President
P. O. Box 156
Kaunakani, Hawaii 96747
Phone: 335-5337

WAILUKU AGRIBUSINESS CO., INC.^c
S. W. Knox, President
P. O. Box 520
Wailuku, Hawaii 96793
Phone: 244-7079

CASTLE & COOKE, INC.

WAIALUA SUGAR CO., INC.
J. H. Hewetson, Pres. & Gen. Mgr.
P. O. Box 665
Waialua, Hawaii 96791
Phone: 637-6284

HAMAKUA SUGAR CO., INC.

J. A. Poppe, Exec. Vice Pres. & Gen. Mgr.
P. O. Box 250
Paauilo, Hawaii 96776
Phone: 775-7261

GAY & ROBINSON, INC.^d

W. S. Robinson, President
Makaweli, Hawaii 96769
Phone: 338-8233

^a Sugarcane milling company cooperatively owned by United Cane Planters' Cooperative and Mauna Kea Agribusiness Co., Inc.

^b Mauna Kea Agribusiness Co., Inc. is a grower which delivers its cane to Hilo Coast Processing Co.

^c Wailuku Agribusiness Co., Inc. is a grower whose cane is milled by Hawaiian Commercial & Sugar Co.

^d Gay & Robinson, Inc. is a grower whose cane is milled by Olokele Sugar Co., Ltd.

HSPA SUGAR MANUAL 1987

A Handbook of Statistical Information
PUBLISHED BY

Hawaiian Sugar Planters' Association

OFFICERS/1987

F. S. MORGAN	- Chairman
J. W. A. BUYERS	- Vice Chairman
D. J. HEINZ	- President
	- Director of the Experiment Station
E. C. RAVNHOLT	- Vice President
	- Washington Representative
D. J. DOUGHERTY	- Secretary-Treasurer

BOARD OF DIRECTORS/1987

W. D. BALFOUR, JR.
J. W. A. BUYERS
J. C. COUCH
G. B. FRASER
R. L. GRIFFITH
J. H. HEWETSON
F. S. MORGAN
R. J. PFEIFFER
J. A. POPPE
M. J. TILKER

Headquarters:

99-193 Aiea Heights Drive
P. O. Box 1057
Aiea, Hawaii 96701
(808) 487-5561

Washington Office:

1511 K Street, N.W., Suite 723
Washington, D. C. 20005
(202) 628-6372

Experiment Station:

Dr. D. J. Heinz, Director
99-193 Aiea Heights Drive
P.O. Box 1057
Aiea, Hawaii 96701
(808) 487-5561

CONTENTS

Part I — HAWAII'S SUGAR INDUSTRY

Sugar Companies Directory	2
HSPA Officers, Directors	3
Sugar In Hawaii	4
Map -- Hawaii's Sugar Islands	4
Table -- Hawaii Sugar Production - 1986 ..	5
Sugar In Hawaii - 1986	6
Graph -- Sugar Production Costs, Returns & Refined Sugar Retail Price	6
Hawaii State & Sugar Lands	7
Wages & Working Conditions	7
Table -- Raw Sugar Prices, Average Earnings, Employment, Man-Days	8
Hawaiian Sugar Planters' Assn.	9
California & Hawaiian Sugar Co.	9
Table -- Hawaii Production 1908-86	10

Part II — U. S. SWEETENER INDUSTRY

U. S. Sweetener Industry	12
Table -- U. S. Caloric Sweetener Use	12
Maps -- Sweetener Sources States	13
Table -- U. S. Sugar Supply Sources	14
Table -- Per Capita Consumption, Sweeteners 1970-86	15
Map -- Cane Sugar Refineries	16
Graph -- Caloric Sweetener Consumption 1967-86	16
Graph -- Wholesale Sugar & HFCS Prices ..	17
Table -- U. S. Sugar Deliveries 1982-86 ...	17
U. S. Sugar Legislation	18
Graph -- Consumer Price Index & Sugar Prices 1982-86	19
Table -- Farm Act Loan Rates, MSP & U. S. Raw Sugar Prices	19

Part III — WORLD SUGAR

World Sugar	21
Table -- Ten Largest Producing, Exporting, Importing and Consuming Nations	21
Table -- World Production, Consumption, Imports & Exports	21
Table -- World Production, Consumption, Stocks & Price Impact	22
Table -- World Supply & Distribution	23
International Sugar Agreement	26
Graph -- ISA Price Mechanism	26
GLOSSARY	27

SUGAR IN HAWAII

Hawaii's sugar industry in 1985 observed its 150th year of commercial raw cane sugar production. Sugar, more than any other activity over the past century-and-a-half, helped create modern Hawaii.

The first successful plantation was started at Koloa, Kauai in 1835. Its first harvest in 1837 produced 2 tons of raw sugar which sold for \$200. Other pioneers, predominantly from the United States, soon established sugar on the islands of Maui, Oahu, and Hawaii.

Early sugar planters shared many common problems—lack of water, lack of labor, lack of markets, and trade barriers. These, along with Hawaii's isolated mid-Pacific location, created a spirit of cooperation continuing today.

Between 1852 and the end of World War II, labor shortages were eased by bringing to Hawaii contract workers from Europe, North America, and Asia. In all, nearly 385,000 workers were brought to Hawaii. Many thousands stayed, establishing Hawaii's unique ethnic mix.

Pioneer sugar planters relieved water shortages in the dry, leeward areas by developing irrigation systems which included aqueducts (beginning in 1856), artesian wells (1879), and tunnels and wells in mountains which tapped sources of fresh water (1898). This water development opened up

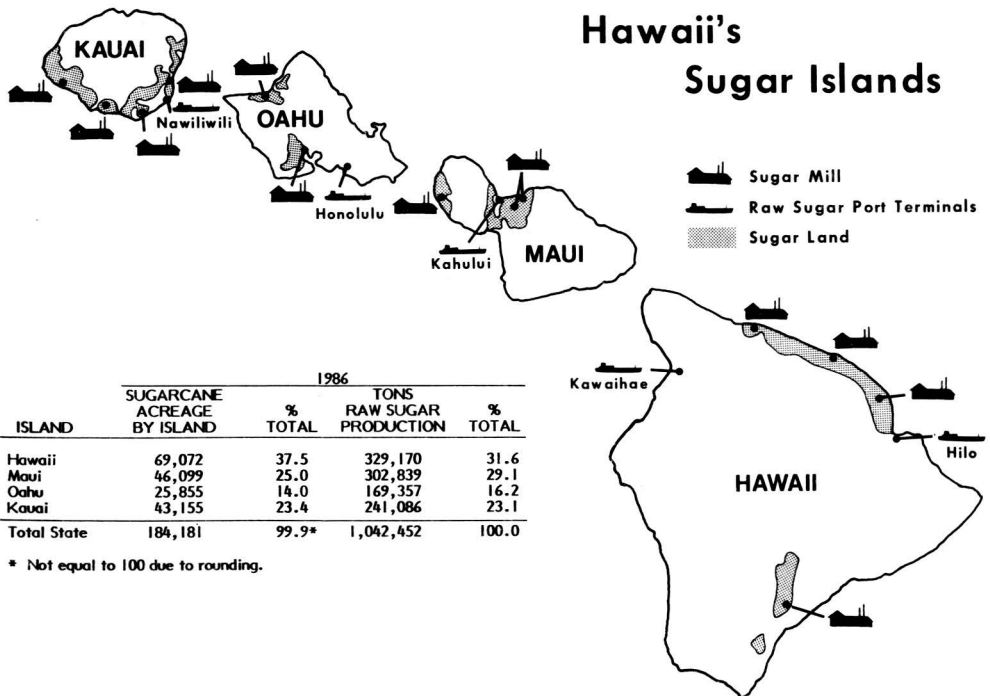
more than 100,000 acres of arid land to sugarcane cultivation.

The major trade barrier to Hawaii's closest and major market for its raw sugar was eliminated with the 1876 Treaty of Reciprocity between the U. S. and the Kingdom of Hawaii. America received a Pacific coaling station and Hawaiian sugar duty-free U. S. entry. This market was confirmed with U. S. annexation of Hawaii in 1898 following the Spanish-American War.

From 2 tons of sugar in 1837, Hawaiian production had reached only 13,000 tons by 1876; but reciprocity and annexation changed that drastically. By annexation in 1898, production had grown to 225,000 tons and would grow to 1 million tons by 1932, a level Hawaii has since averaged.

The State of Hawaii has few natural resources and must import most of its essentials—food, fuel, machinery, building materials, etc. Thus, activities capable of bringing new dollars into the economy are critical to Hawaii's balance of trade and its standard of living.

For nearly 100 years, sugar production and other agriculture was the leading economic activity, providing Hawaii its major sources of employment, tax revenues, and new capital through "exports" of raw sugar and other products.



FACTS & FIGURES

- Sugarcane is a "monoculture" in Hawaii. Some fields have been in continuous production for 150 years.
- Hawaii is one of the few sugar areas in the world where the crop age averages two years at time of harvest.
- Hawaii yields of sugar are among the highest in the world, about 12.5 tons an acre in 1986 (6.25 tons on an annual basis).
- Approximately 113,000 of Hawaii's 184,000 acres of sugarcane are irrigated, producing two-thirds of Hawaii's sugar.
- Hawaiian sugar's water system includes 115 fresh and brackish wells; 247 reservoirs with a total capacity of 10.3 billion gallons; 11 hydro-electric installations; 350 miles of major ditches; and 120 miles of tunnels.
- Replacement of the sugar water system would cost \$1.25 billion. All was built without any government subsidy.
- Hawaiian sugar provides about 25,000 direct and indirect jobs in the state.
- Direct sugar payroll costs, including employee benefits, totaled \$129 million in 1986.
- Hawaii's sugar field workers have the highest standard of living of any agricultural workers in the world, with daily earnings (including benefits) averaging \$103.52 in 1986.
- Principal products of the Hawaiian sugar industry are raw sugar, molasses and electricity (primarily from biomass).
- Hawaii's sugar industry generates about 10 percent of all electricity produced in Hawaii.

However, with statehood in 1959 and the almost simultaneous introduction of jet aircraft, Hawaii's tourist industry began an extended period of rapid growth and, within a decade, became Hawaii's largest economic sector.

Today, Hawaii's economy can be likened to a three-legged stool, with the legs being tourism, federal expenditures (primarily defense-related), and agriculture. The stability of Hawaii's economy can be critically disturbed by a sudden

change or reduction in any one area.

In 1986, state tourism revenues were estimated at \$5.5 billion, federal defense expenditures at \$1.9 billion, and agriculture about \$840 million.

In the agriculture sector, sugar revenues were \$377 million, pineapple \$241 million, and other agriculture (macadamia nuts, papaya, flowers, etc.) revenues were estimated at \$225 million.

HAWAIIAN SUGAR COMPANIES PRODUCTION - 1986 (Raw Value)

	Total Cane/land Acreage	Acreage Harvested	Production (short tons)	Tons Sugar Per Harvested Acre
ALEXANDER & BALDWIN, INC. (A&B)				
Hawaiian Commercial & Sugar Co. (Maui)	35,890	16,515	229,228	13.88
McBryde Sugar Co., Ltd. (Kauai)	12,379	5,700	54,488	9.56
TOTAL A&B	48,269	22,215	283,716	12.77*
AMFAC, INC. (Amfac)				
Kekaha Sugar Co., Ltd. (Kauai)	8,351	4,004	54,012	13.49
The Lihue Plantation Co., Ltd. (Kauai)	14,936	7,646	78,941	10.32
Oahu Sugar Co., Ltd. (Oahu)	14,023	6,823	96,891	14.20
Pioneer Mill Co., Ltd. (Maui)	7,611	4,001	53,726	13.43
TOTAL AMFAC	44,921	22,474	283,570	12.62*
C. BREWER AND CO., LTD. (Brewer)				
Ka'u Agribusiness Co., Inc. (Hawaii)	16,018	5,579	64,227	11.51
Mauna Kea Agribusiness Co., Inc. (Hawaii)	15,743	6,441	78,434 ^a	12.18
Olokele Sugar Co., Ltd. (Kauai)	4,812	2,333	33,271	14.26
Wailuku Agribusiness Co., Inc. (Maui)	2,597	1,409	19,885 ^b	14.11
TOTAL BREWER	39,170	15,762	195,830	12.42
CASTLE & COOKE, INC. (C&C)				
Waialua Sugar Co., Inc. (Oahu)	11,832	5,253	72,466	13.78
HAMAKUA SUGAR CO., INC. (HSC) (Hawaii)				
	34,688	15,252	171,651	11.25
GAY & ROBINSON, INC. (G&R) (Kauai)				
	2,678	1,233	20,375 ^c	16.53
HILCO COAST PROCESSING CO. (HCPC) (Hawaii)				
				^d
UNITED CANE PLANTERS' COOP. (UCPC)				
(89-member growers, Hawaii Island)	<u>2,623</u>	<u>1,393</u>	<u>14,858^a</u>	<u>10.67</u>
TOTAL ALL COMPANIES	184,181	83,583	1,042,452	12.47

^a Grower only; processing by Hilo Coast Processing Co.

^b Grower only; processing by Hawaiian Commercial & Sugar Co.

^c Grower only; processing by Olokele Sugar Co., Ltd.

^d Produced 93,292 tons raw sugar for growers "a."

* Company average.

SUGAR IN HAWAII—1986

During 1986, Hawaii's sugar industry successfully continued its intense efforts to increase productivity and reduce costs. The program again achieved significant gains. Further, the industry benefited late in the year from stabilized sugar prices, ending a decline that began late in 1984.

Hawaiian sugar's productivity and cost-cutting program began during 1981, a year in which uncontrolled entry of foreign, subsidized sugar flooded the domestic market, and caused an unprecedented \$90 million pre-tax loss for Hawaii's sugar producers.

Operations in 1986 benefited from this program. Per-acre yields of sugar set a fourth consecutive annual record, rising 2.5 percent above the 1985 yield to 12.5 tons. Yields in 1986 were 16 percent above 1981 yields.

These yield increases resulted from improved sugarcane varieties developed by HSPA's Experiment Station; from better use of water through drip irrigation (at the end of 1986, approximately 60 percent of all Hawaiian sugarcane fields were irrigated with 80 percent of them under drip); from improved agricultural and cane ripening practices; from efforts to reduce sugar losses in

cane harvesting and transportation; and from increasing recovery in processing operations.

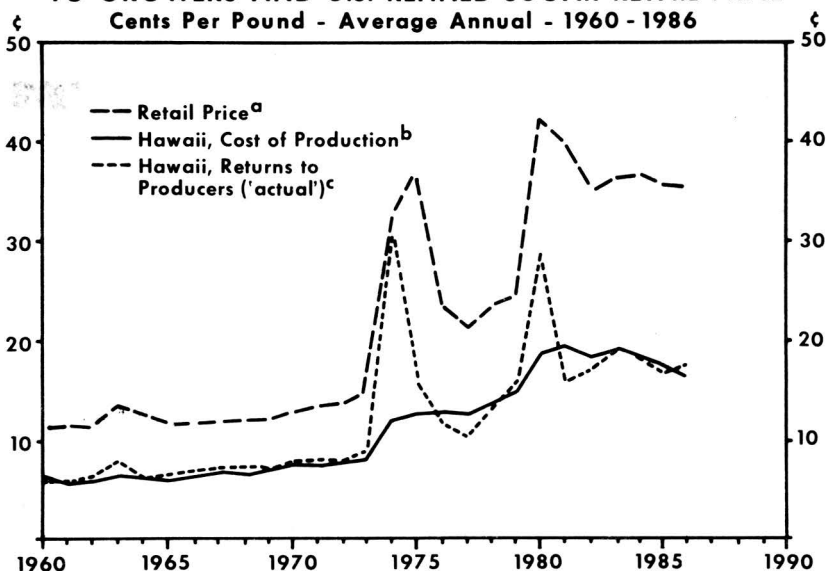
In 1986, the Hawaiian industry produced 1,042,452 tons of raw cane sugar, compared with 1,012,249 tons in 1985. The primary reason for the year-to-year increase was higher sugar yield per acre.

Molasses production was 290,422 tons, compared with 271,645 tons in the prior year.

Electricity produced and sold to utility companies for public consumption increased 30 percent to 433,000 megawatt hours. In 1985, 333,000 megawatt hours were sold. The principal reason for the year-to-year increase was good rainfall patterns which increased mountain water ditch flows and reduced power requirements to operate irrigation systems.

Operations were aided by the addition (in 1985) of 100,000 tons of new raw sugar storage capacity, which increased the industry's total capacity to 340,000 tons -- about a third of a normal year's production. This enabled the Hawaii industry to continue uninterrupted operations during a three-month strike in the spring of 1986 by refinery workers at C&H Sugar Co.'s Crockett, Calif. plant.

HAWAIIAN RAW SUGAR COST OF PRODUCTION, RETURN TO GROWERS AND U.S. REFINED SUGAR RETAIL PRICE



^a U. S. price granulated sugar at retail.

^b Hawaii cost of production (raw value basis) is weighted average annual cost of producers who grow and mill sugarcane. Source: HSPA. (Note: From 1956-1971, cost of transportation of raw sugar and molasses was paid by the producers; since 1972 by C&H; thus costs have been slightly lower than they would have been without the change, but returns have been reduced by the same amount.)

^c Returns to Hawaii producers represent sales of raw sugar and molasses by C&H. Does not include compliance payments made under the U. S. Sugar Act which terminated in 1974. Such payments averaged less than 1/2 cent per pound. Does not include payments under the 1977 U.S. program which amounted to 2-3/4 cents per pound for one crop only.

Sources: 1960-76, USDA Agricultural Statistics; 1977-86, USDA Sugar and Sweetener Reports; HSPA.

The increase in raw sugar production, coupled with operating efficiencies and lower fuel costs, enabled the industry to again reduce its average cost of production. The 1986 cost was \$312.10 a ton (15.61 cents a pound) -- \$20.67 a ton (1-cent a pound) below 1985. This progress continued the industry's successful cost reduction program started in 1981. Costs in 1986 were 15.2 percent below those of five years earlier.

Prior to 1986, benefits from this program were offset by falling sugar prices, which prevented the industry from realizing an improved financial position.

(In 1985, total industry revenues declined 11.5 percent below those of 1984. Almost all island sugar planters lost money and the industry's net loss was greater than in 1984.

(U. S. raw sugar prices fell below the Farm Act's market stabilization price in November 1984 and remained below through 1986. This was primarily caused by excessive foreign sugar import quotas, a situation compounded in late 1984 when major soft drink manufacturers switched product sweetening formulas to all-high-fructose corn syrups, eliminating the use of sugar. This latter event further intensified price competition in the western U. S. where Hawaiian cane sugar competes with western beet sugar.)

But in 1986, the industry average return per ton of sugar was up slightly -- to \$332 a ton, or 80 cents-a-ton above the average 1985 return of \$331.20.

This improvement resulted from new provisions enacted by Congress in the Food Security Act of 1985, also known as the Farm Act. These required the Federal Administration to operate the sugar program at no cost to the government. This mandated the Administration to extend the 1986 sugar import quota by three months. This stabilized and then slightly strengthened prices near year-end.

Higher sugar production and slightly higher prices, better molasses prices and a very modest increase in electricity revenues produced total industry revenues of \$376.7 million, compared with \$361 million in 1985.

This resulted in the industry being modestly profitable, but with a return on capital invested (nearly \$300 million) of less than 4 percent. Despite this improvement some of the industry's companies and growers had losses in 1986.

Sugar Lands

The Hawaiian Islands make up America's fourth smallest state. The islands are the tops of volcanic mountains, some still active. Only certain low lands near the coasts are tillable because of the rugged terrain and character of the soils. The balance is in forest, pasture, conservation, or unuseable land.

Hawaii's sugar companies are located along the coastlines of four islands and push upwards into foothills and mountains.

In 1986, 184,181 acres were devoted to sugarcane cultivation with another 21,000 acres used for mill sites, private roads, irrigation systems, etc.

Island Land Areas with Sugar

Island	Length Miles	Width Miles	Area Square Miles ^a	Acres 000's	1986 Total Sugar Acres ^b
Hawaii.	93	76	4,038	2,584	69,072
Maui.	48	26	729	466	46,099
Oahu.	44	30	608	388	25,855
Kauai.	33	25	553	354	43,155
Molokai.	38	10	261	167	--
Lanai.	18	13	139	89	--
Niihau.	18	6	73	46	--
Kahoolawe.	11	6	45	28	--
Minor Islands	--	--	4	2	--
Total			6,450	4,128	184,181

^a Includes inland water.

^b Excludes mill sites, roads, etc.

WAGES & WORKING CONDITIONS

Hawaii's sugar workers, both field and factory, are members of the International Longshoremen's and Warehousemen's Union (ILWU). A contract negotiated with the ILWU, from February 1, 1986 through January 31, 1988, included wage rates from a minimum of \$7.00 (Grade I) to \$9.79 (Grade II) per hour. Effective February 1, 1987 wage rates increased 3.3 percent, with Grade I employees receiving \$7.23 per hour and Grade II employees earning \$10.115 an hour.

Unlike some farming areas where crops are seasonal, Hawaii's sugar industry provides year-round, long-term employment.

In 1986 the payroll for all Hawaii's sugar workers amounted to \$129,069,450 with daily earnings (wages and benefits) averaging \$103.52.

Approximate Employment by Occupation at Sugar Companies

Factory	1,355
Field	3,530
Clerical	190
Miscellaneous	615
Supervisors.	820
Total	6,510

Year-round employees receive up to four weeks vacation with pay, 10 paid holidays a year; paid sick leave for up to 54 days plus a temporary

disability supplement for extended illness, a medical plan, a family dental care plan, retirement pensions, severance pay, and many other benefits.

AVERAGE RAW SUGAR PRICE, EARNINGS, EMPLOYEES & MAN-DAYS

All Hourly Rated Employees Only, On Hawaiian Sugar Plantations

	Average New York Raw Sugar Price cents per pound (Hawaiian Basis) ^a	Average Daily Wages ^b	Value Average Daily Employee Benefits	Total Value Average Daily Wages/Benefits	Adult Hourly Rated Employees ^c	Total Man-Days Hourly Rated Employees
1940	2.78	\$ 2.18	NA	NA	35,062	9,994,863
1945	3.75	5.10	NA	NA	20,806	6,350,489
1950	5.93	8.30	NA	NA	19,340	5,069,682
1955	5.95	10.62	NA	NA	15,935	3,896,761
1960	6.31	13.18	4.40	17.58	12,111	2,917,459
1965	6.75	18.40	6.50	24.90	10,346	2,505,839
1970	8.08	24.24	10.00	34.23	8,908	2,139,183
1971	8.52	26.08	10.27	36.35	8,610	2,077,011
1972	9.10	29.09	11.23	40.32	8,127	1,934,563
1973	10.30	30.86	12.48	43.34	7,900	1,897,369
1974	29.43	34.41	15.81	48.73	7,700 ^d	1,744,346 ^d
1975	22.49	37.34	15.66	53.00	7,800	1,937,973
1976	13.31	43.12	17.28	60.40	7,500	1,854,272
1977	11.11 ^e	43.92	19.97	63.89	7,200 ^f	1,660,298 ^f
1978	13.74	47.06	21.28	68.34	7,200	1,771,530
1979	15.20 ^g	50.49	22.21	72.70	7,065	1,762,838
1980	30.18	56.72	24.68	81.40	7,076	1,793,237
1981	19.74	61.51	27.71	89.22	7,282	1,806,020
1982	19.94	65.11	30.83	95.94	6,816	1,519,732
1983	22.04	66.80	32.00	98.80	6,543	1,565,928
1984	21.74	68.88	34.71	103.59	6,319	1,467,127
1985	20.39 ^h	68.72	35.99	104.71	5,751	1,323,525
1986	20.90 ^h	69.28	34.24	103.52	5,413	1,290,067

^a Hawaiian basis is the average New York raw sugar price computed over all the days in the year. The New York price is computed for days the New York market is operating.

^b Cash wage only. Does not include "employee benefits."

^c Prior to 1947 included only male adults.

^d 1974: industry-wide strike, 6 weeks.

^e New York spot price discontinued Nov. 2, 1977; after that date based on Clearing Association settlement prices.

^f 1977: industry-wide strike, 3 weeks.

^g New York spot price reinstituted on Aug. 20, 1979.

^h New York spot price "nearby futures," effective June 1985. Effective Jan. 1, 1986, "nearby" No. 14 contract futures.

NA = Not available.

INDUSTRY ORGANIZATION

Hawaiian Sugar Planters' Association

On March 23, 1882, sugar growers in the then Kingdom of Hawaii met and organized the Planters' Labor and Supply Company. This organization evolved into the Hawaiian Sugar Planters' Association, with a change in name and bylaws in 1895, but with no break in the objectives, membership, etc., from the Planters' Labor and Supply Company.

The Association is a voluntary, nonprofit, incorporated association organized for the maintenance, advancement, improvement, and protection of the sugar industry in Hawaii and the support of a sugarcane research station. Companies engaged primarily in the business of growing sugarcane and manufacturing sugar from it are plantation members of the Association; individuals who are directly connected with the direction, management, or operation of the sugar companies are individual members.

The Association compiles information, answers inquiries, and coordinates activities on problems of common interest and concern to its members. In addition to the Association's staff, many of these functions are carried out through the following standing committees: Accounting, Energy, Environmental Standards, Experiment Station Advisory, Industrial Relations, Insurance, Land and Water, Legal Advisory, Legislative, Public Relations, Raw Sugar Technical, Retirement Plans, and Tax.

The Association has maintained an office in Washington, D. C. since 1898. A vice president represents member company interests in federal legislative, administrative, and regulatory activities.

HSPA Experiment Station

The Association's single largest program is research conducted through its Experiment Station. The station conducts research on sugarcane for the benefit of all sugarcane growers and processors in Hawaii. Industry research began in 1895 and has made consistent and substantial improvements in methods of growing and processing sugarcane.

The largest, single program in the Experiment Station is the development of new sugarcane varieties. The station has been a world leader in developing methods of breeding sugarcane. Other important contributions have been development of irrigation systems and methods of insect, disease, weed, and rat control. It has improved sugarcane factory processes and methods of factory process control, and its work has resulted in higher sugar recovery and in improvements on raw sugar quality. Although its research is directed at practical problems in growing and milling sugarcane, it performs basic research on the basic physiology and biochemis-

try of the sugarcane plant when such information is not available from other sources.

The Experiment Station provides many important services to its member companies, such as analyses of raw sugar and molasses; plant and soil analyses to determine fertilizer needs; repair and calibration of sugar factory instruments; field, factory, and factory laboratory audits; and training courses for employees of member companies.

In addition to its headquarters, offices and laboratories in Aiea on Oahu, the Experiment Station has substations on each of the four islands on which sugarcane is grown--Oahu, Maui, Kauai, and Hawaii. One of its principal substations on the Island of Oahu exists specifically for the purpose of maintaining breeding varieties and for crossing them to develop improved varieties. The Experiment Station also has a large and complete library, with a collection of reference books and periodicals on sugarcane growing and milling, as well as a comprehensive collection of journals and reference books on agriculture, chemistry, and engineering.

California and Hawaiian Sugar Company

The California and Hawaiian Sugar Company (C & H) was founded in 1906 and has been an agricultural cooperative marketing association since 1921. It is proportionately owned by its 13 member sugar producing companies in Hawaii. It also serves the approximately 145 independent sugarcane farmers in Hawaii.

C & H is the leading sugar brand in its markets. The company operates refineries at Crockett, California, and Aiea, a suburb of Honolulu, Hawaii. The company markets all raw sugar and molasses produced in Hawaii. Except for some raw sugar sold to other refineries, C & H refines, packages and markets the output of Hawaii's 13 sugar factories.

C & H's primary market is the western United States, although some sugar is sold as far east as the Mississippi River. More than 100 types, grades, and package sizes are sold within two major groupings of grocery and industrial products.

Over the past decade, annual sales of C & H have averaged \$525 million, returning an average of \$364 million a year to Hawaii's raw sugar producers. The company employs approximately 1,200 persons in mainland refining and marketing operations and about 65 persons at its Aiea refinery. The C & H payroll totals about \$35 million annually.

John B. Bunker is president and chief executive officer of C & H. Company headquarters are at 1390 Willow Pass Road, Concord, CA 94520.

CANE SUGAR: PRODUCTION IN HAWAII

(Short Tons)

Calendar year ^a	SUGARCANE PRODUCTION					SUGAR PRODUCED		Pounds raw sugar (96°) made per short tons of cane	BY-PRODUCTS	
	Tons sugar per acre	Tons cane per ton sugar	Total cane land acres	Acres cane harvested ^b	Tons average yield per acre	Tons cane production	Raw tons converted to 96° value ^c	Refined tons equivalent ^d	Tons molasses production ^e	Electricity sold for public consumption megawatts hours
1908-1909 . . .	5.14	7.42	201,641	106,127	38.2	4,050,000	545,738	510,048	270	
1909-1910 . . .	4.81	7.78	209,469	110,247	37.4	4,122,000	529,940	495,282	257	
1910-1911 . . .	5.16	7.94	214,312	112,796	41.0	4,623,000	582,196	544,120	252	
1911-1912 . . .	5.34	7.75	216,345	113,866	41.4	4,711,000	607,863	568,109	258	
1912-1913 . . .	4.90	7.99	215,741	113,548	39.1	4,445,000	556,654	520,249	250	
1913-1914 . . .	5.54	8.01	217,470	112,700	44.4	5,000,000	624,165	583,345	250	
1914-1915 . . .	5.75	7.96	239,800	113,164	45.8	5,184,393	650,970	608,397	251	
1915-1916 . . .	5.17	8.14	246,332	115,419	42.1	4,859,424	596,703	557,679	246	
1916-1917 . . .	5.57	7.98	247,476	117,468	44.4	5,220,000	654,388	611,591	251	
1917-1918 . . .	4.86	8.34	246,813	119,785	40.5	4,855,804	582,192	544,117	240	
1918-1919 . . .	5.07	7.81	239,844	119,679	39.6	4,744,070	607,174	567,465	256	
1919-1920 . . .	4.91	7.98	247,838	114,105	39.2	4,473,498	560,379	523,730	251	
1920-1921 . . .	4.83	8.53	236,510	113,056	41.2	4,657,222	546,273	510,547	235	
1921-1922 . . .	4.98	8.23	228,519	124,124	41.0	5,088,062	618,457	578,010	243	
1922-1923 . . .	4.85	8.23	235,134	114,182	39.9	4,559,819	554,199	517,954	243	
1923-1924 . . .	6.42	7.91	231,862	111,581	50.7	5,661,000	715,918	669,097	253	
1924-1925 . . .	6.47	8.06	240,597	120,632	52.2	6,297,000	781,000	730,000	248	
1925-1926 . . .	6.58	8.07	237,774	122,309	53.1	6,495,686	804,644	752,020	248	
1926-1927 . . .	6.68	8.41	234,809	124,542	56.1	6,992,082	831,648	777,258	238	
1927-1928 . . .	7.00	8.37	240,769	131,534	58.6	7,707,330	920,887	860,661	239	
1928-1929 . . .	7.16	8.05	239,858	129,131	57.7	7,447,494	925,140	864,636	248	
1929-1930 . . .	7.02	8.36	242,761	133,840	58.7	7,853,439	939,287	877,858	239	
1930-1931 . . .	7.43	8.33	251,533	137,037	61.9	8,485,183	1,018,047	951,467	240	
1931-1932 . . .	7.57	8.38	251,876	139,744	63.4	8,865,323	1,057,303	988,155	239	
1932-1933 . . .	7.34	8.05	254,563	144,959	59.1	8,566,781	1,063,605	994,045	248	
1933 (10/1-12/31)	---	---	---	---	---	---	---	---	---	---
1934	7.14	8.33	252,237	134,318	59.5	7,992,260	959,337	896,596	240	
1935	7.82	8.67	246,491	126,116	67.8	8,555,424	986,849	922,309	231	
1936	7.97	8.80	245,891	130,828	70.1	9,170,279	1,042,316	974,149	227	
1937	7.46	9.32	240,833	126,671	69.5	8,802,716	944,382	882,619	215	
1938	6.92	9.39	238,302	135,978	65.0	8,835,370	941,293	879,732	213	
1939	7.18	8.66	235,227	138,440	62.2	8,609,543	994,173	929,154	231	
1940	7.16	8.76	235,110	136,417	62.7	8,557,216	976,677	912,802	228	
1941	7.24	9.04	238,111	130,768	65.5	8,559,797	947,190	885,244	221	
1942	7.58	9.10	225,199	114,745	69.0	7,918,342	870,099	813,195	220	
1943	7.79	9.24	220,928	113,754	71.9	8,185,400	885,640	827,719	216	
1944	7.99	8.95	216,072	109,522	71.5	7,832,185	874,947	817,725	223	
1945	7.96	8.98	211,331	103,173	71.4	7,371,158	821,216	767,509	223	
1946	8.06	8.83	208,376	84,379	71.1	6,002,127	680,073	635,596	212,230	
1947	7.72	9.11	211,624	113,020	70.3	7,942,216	872,187	815,146	220	285,190
1948	8.35	9.03	206,550	100,042	75.4	7,542,613	835,107	780,491	221	254,740
1949	8.76	8.44	213,354	108,794	73.9	8,045,941	955,890 ^f	893,375	238	251,500
1950	8.78	8.51	220,383	109,405	74.7	8,174,821	960,961 ^f	898,114	235	259,130
1951	9.09	8.51	221,212	109,494	77.4	8,477,201	955,759	930,636	235	270,585
1952	9.44	8.52	221,990	108,089	80.4	8,693,920	1,020,450	953,712	235	259,360
1953	10.15	8.19	221,542	108,337	83.1	9,003,967	1,099,316	1,027,421	244	287,480
1954	10.02	8.75	220,138	107,480	87.75	9,431,781	1,077,347	1,006,889	228	306,910
1955	10.74	8.66	218,819	106,180	92.94	9,867,978	1,140,112	1,065,525	231	295,550
1956	10.28	9.01	220,606	106,956	92.65	9,909,990	1,099,543	1,027,633	222	305,580
1957	10.16	8.71	221,336	106,742	88.51	9,447,647	1,084,646	1,013,710	230	303,700
1958	9.09	9.87	221,683	84,136	89.77	7,552,750	764,953	714,925	203	307,210
1959	8.83	9.66	222,588	110,371	85.31	9,416,225	974,632	910,891	207	330,790
1960	9.03	9.20	224,617	103,584	83.15	8,613,317	935,744	874,546	217	299,590
1961	10.09	8.78	227,027	108,320	88.58	9,595,342	1,092,481	1,021,033	228	329,960
1962	10.31	8.76	228,926	108,600	90.36	9,812,580	1,120,011	1,046,762	228	335,510
1963	10.25	9.12	231,321	107,436	93.39	10,033,969	1,100,768	1,028,777	219	322,610
1964	10.64	8.90	233,145	110,759	94.76	10,495,175	1,178,770	1,101,678	225	336,250
1965	11.11	8.82	235,576	109,600	97.97	10,737,507	1,217,667	1,138,033	227	340,190
1966	11.12	8.89	237,499	111,005	98.82	10,969,925	1,234,121	1,153,409	225	349,540
1967	10.65	9.27	239,813	111,837	98.74	11,045,949	1,191,042	1,113,148	216	359,170
1968	10.85	9.15	242,476	113,525	99.36	11,279,920	1,232,182	1,151,597	218	368,050
1969	10.44	9.17	242,216	113,232	95.73	10,839,272	1,182,414	1,105,060	218	340,330
1970	10.21	9.00	238,997	113,816	91.88	10,457,377	1,162,071	1,086,000	222	322,480
1971	10.62	8.69	232,278	115,810	92.26	10,685,019	1,229,976	1,149,510	230	330,227
1972	10.32	8.87	229,611	108,456	91.55	9,929,068	1,118,883	1,045,708	225	307,543
1973	10.43	8.55	226,580	108,189	89.15	9,645,452	1,128,529	1,054,723	234	301,500
1974	10.86	8.73	224,227	95,826	94.76	9,082,684	1,040,742	972,677	229	293,380
1975	10.53	8.57	221,426	105,125	90.23	9,485,299	1,107,199	1,034,788	233	301,335
1976	10.51	8.73	221,551	99,926	91.79	9,172,649	1,050,457	981,757	229	275,352
1977	10.68	8.70	220,729	96,770	92.95	8,994,388	1,033,739	966,132	230	284,349
1978	10.36	9.00	220,697	99,355	93.23	9,263,190	1,028,933	961,641	222	310,238
1979	10.53	9.09	218,773	100,610	95.74	9,632,135	1,059,737	990,430	220	325,843
1980	10.51	9.00	217,718	97,358	94.64	9,214,136	1,023,232	956,313	222	315,088
1981	10.74	8.43	216,099	97,573	90.51	8,831,477	1,047,541	979,032	237	311,719
1982	11.01	8.96	204,749	89,261	98.68	8,807,998	982,913	918,630	224	287,190
1983	11.25	8.55	194,258	92,808	96.18	8,926,358	1,044,204	975,913	234	303,254
1984	11.86	7.96	188,396	89,541	94.41	8,453,721	1,061,814	992,371	251	314,202
1985	12.19	7.82	187,858	83,029	95.35	7,916,459	1,012,249	946,048	256	271,645
1986	12.47	8.04	184,181	83,583	100.25	8,379,463	1,042,452	974,276	249	290,422

^a Until 1934 represented period October 1 through September 30.^b The average growth of a crop is from 22 to 26 months. Only a portion of the total acreage in cane is harvested each year.^c Converted in accordance with Sugar Regulations, Series I, No. 1, U.S. Department of Agriculture, Agricultural Adjustment Administration, issued February 18, 1935, or Section 101(h) of the Sugar Act of 1948 or corresponding provisions of its predecessors as the case may be.^d 1 ton of sugar, 96° test is assumed to be equivalent to 0.9346 tons of refined.^e Actual weight; unconverted to 85% Brix.^f Includes 2,369 tons raw sugar produced from volunteer cane for which no acreage shown.^g Includes 2,690 tons raw value sugar produced from volunteer cane for which no acreage shown.

U. S. SWEETENER INDUSTRY

More than 15.5 million tons of natural, caloric sweeteners--virtually all cane and beet sugar and corn syrups--were consumed in the U. S. during 1986. On a per capita basis, that means an estimated 129.7 pounds for each of America's 241.5 million people.

Consumption appears to be stabilizing. In the 1970s it averaged 123.2 pounds per person. In the first seven years of the 1980s, per capita use

imports are regulated by country-by-country quota allocations awarded 39 nations.

Of the 6.59 million short tons of (raw basis) sugar produced in the U. S. in 1986, approximately 3.33 million tons were from sugar beets and 3.26 million from sugarcane. Imported raw cane sugar totaled 1.75 million tons. Sugar deliveries for all uses totaled 7.81 million tons (refined).

U. S. CALORIC SWEETENER USE 1975, 1980, 1982-1986 Millions Short Tons - Dry Basis

	Sugar Raw ^a	Sugar Refined	High Fructose Corn Syrup	Total Corn Sweeteners HFCS, Glucose & Dextrose	Honey & Edible Syrups	Total
1975	10.30	9.63	0.54	2.97	0.15	12.75
1980	10.19	9.52	2.18	4.58	0.14	14.24
1982	9.16	8.56	3.10	5.60	0.15	14.31
1983	8.92	8.33	3.60	6.12	0.15	14.61
1984	8.57	8.01	4.30	6.84	0.17	15.02
1985	8.11	7.58	5.20	7.77	0.17	15.52
1986	7.89	7.37	5.53	8.12	0.17	15.66

^a Raw sugar figure obtained by multiplying refined sugar by conversion factor of 1.07.

Source: USDA Sugar and Sweetener Situation and Outlook Report, Vol. 12(1), March 1987.

averaged 126.4 pounds, reaching a high of 131.2 pounds in 1985.

The balance of national sweetener needs were met by chemical low- and non-caloric sweeteners--aspartame and saccharin, respectively. Combined per capita consumption of the two chemicals in 1986 has been estimated at 18.5 pounds (sugar equivalent basis).

Total per capita consumption of all types of sweeteners in 1986 is estimated at 148.2 pounds.

Approximately 80 percent of all caloric sweeteners is consumed as ingredients in industrial products--cereal and bakery products, confections, ice cream and other dairy products, beverages, prepared foods, and jams and jellies.

The remaining 20 percent of consumption is direct--purchased from wholesalers, jobbers, etc., and retailers for use in homes, restaurants, by government and other institutions.

In 1986, 47 percent of all caloric sweeteners used was sugar--domestic and imported cane sugar, and domestic beet sugar. A little more than half was corn sweeteners--high-fructose, glucose and dextrose corn syrups. Also, small amounts (about 1.4 pounds per capita) of edible syrups and honey were consumed.

SUGAR INDUSTRY

American sugar needs are met from domestic and foreign sources. In 1986, the U. S. produced nearly 78 percent of its sugar needs. U. S.

Cane Sugar Production

Sugarcane is grown and milled in the states of Florida, Hawaii, Louisiana, and Texas, and in the Commonwealth of Puerto Rico.

Sugarcane is a one-year crop (10 to 15 months) in all but Hawaii where it averages two years.

Florida is the leading raw cane sugar producing state (1.476 million tons estimated in 1986), followed by Hawaii (1.04 million tons), Louisiana (0.65 million tons), Texas (0.09 million tons) and Puerto Rico (0.1 million tons).

Hawaii produces the most sugar per acre. In 1986, yields were 12.5 tons an acre (6.25 tons on an annualized basis). Hawaii was followed by Florida (3.55 tons), Louisiana (2.62 tons), Texas (2.56 tons) and Puerto Rico (1.82 tons).

In 1986, 37 raw sugar factories were reported operating; in 1975--62.

U. S. raw cane sugar production increased from an average of about 2.7 million tons (1975-77) to 3.2 million in 1986, due chiefly to the expansion of the Florida industry (803,000 tons in 1975 versus 1.4 million tons in 1986). During the same time frame, Puerto Rico production declined about 200,000 tons and Hawaii production dropped about 65,000 tons.

Total cane sugar refined tonnage has dropped in recent years reflecting a reduction of foreign imports.

Beet Sugar Production

Sugar beets in 1987 were grown on 1.25 million acres in 12 mid-west, great plains, and western states.

The leading sugar beet-producing states in 1987 were Minnesota, California, Idaho, and North Dakota.

In 1987, 28.0 million tons of sugar beets were harvested. Sugar production was 3.96 million tons (raw value) of beet sugar. Production averaged 3.8 million tons during 1975-77. Thirty-six beet sugar factories were reported in operation in 1987, compared with 56 in 1975. Two Colorado factories reopened in 1986.

Although beet sugar production is converted to a raw basis for comparison purposes, beets are processed in a single operation to refined sugar. This is unlike sugarcane which is first processed into raw sugar and then shipped in bulk to refineries serving large urban centers.

CORN SWEETENERS INDUSTRY

Corn is grown in significant quantities in 26 states. In 1987, the USDA estimated U.S. corn sweetener consumption at a record 8.4 million tons (dry basis), a level requiring 492 million

bushels of corn. Corn sweetener consumption in 1987 was 4 percent greater than in 1986.

The dominant corn sweetener product is high-fructose corn syrup (HFCS), a relatively new product that has taken almost all of the U.S. liquid sweetener market from sugar producers. Glucose syrup and dry dextrose also are produced from corn.

HFCS manufacturers have been able to make rapid strides in dominating the liquid sweetener market because they have been able to price the product consistently under sugar. HFCS is one of a group of co-products produced by corn wet millers. Co-products include starch, crude corn oil, gluten feed, and gluten meal.

HFCS is mostly sold as HFCS-55 or HFCS-42. The numerals indicate the percent of fructose in the mixture, with "55" being the equivalent sweetness of sugar. There is also a HFCS-90.

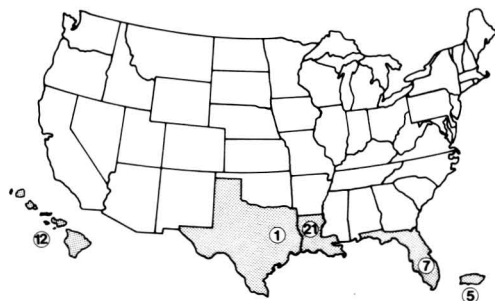
Actual price discounts of HFCS to refined sugar will vary due to a number of factors, foremost of which is the price of sugar. Other factors include demand, excess or limited plant capacity, and variable stocks of corn, soybeans,

(continued on p. 16)

U.S. SOURCES OF CALORIC SWEETENERS

SUGARCANE STATES-4

plus Puerto Rico

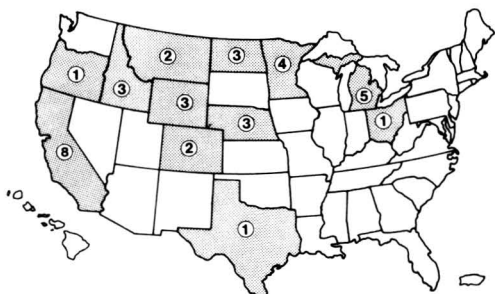


46 Raw cane sugar factories

Thirty-two states produce sugarcane, sugar beets and corn used to manufacture caloric sweeteners for America. Sugarcane is processed into raw sugar in 45 mills located in four states plus Puerto Rico. Sugar beets are refined into beet sugar in 39 factories operating in 13 states. Corn is processed into corn sweetener products in 21 plants located in 13 states. Raw sugar is refined to a finished state in 12 refineries located in 8 states (See map, page 16). About 11 percent of the sugar consumed in the U.S. is imported.

Sources: USDA Sugar and Sweeteners Situation and Outlook Report, Vol. 13(1), March 1988; CPI-U.S. Bureau of Labor Statistics. Compiled by HSPA.

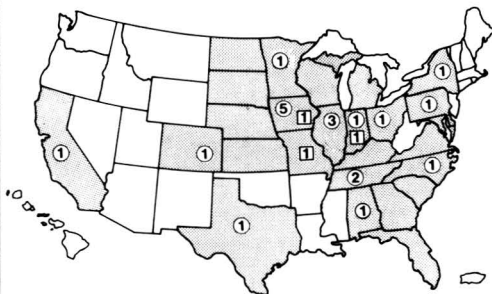
SUGAR BEET STATES-13



36 Beet sugar factories * 2 factories restart 1986

CORN STATES-26

(more than 500,000 bushels each)



19 Corn wet milling plants 2 No HFCS production

U.S. SUGAR SUPPLY SOURCES

1983 - 1987

(1,000 Short Tons-Raw Value, Calendar year)

DOMESTIC	1983	1984	1985	1986	1987
Cane Sugar:					
Florida	1,223	1,412	1,413	1,476	1,572
Hawaii	1,044	1,062	1,012	1,043	979
Louisiana	603	452	532	650	720
Texas	60	81	76	91	97
Total Cane	2,930	3,007	3,033	3,260	3,368
Beet Sugar:	2,699	2,905	3,000	3,331	3,957
Subtotal	5,629	5,912	6,033	6,591	7,325
FOREIGN					
WESTERN HEMISPHERE:					
Caribbean Islands:					
Dominican Republic	457	533	474	317	262
Other ^a	86	93	56	28	57
Total^b	543	626	530	345	319
Central America:					
Belize (British Honduras)	31	29	14	56	15
Costa Rica	64	92	3	72	41
El Salvador	78	68	77	47	1
Guatemala	150	151	113	133	63
Honduras	108	100	50	32	9
Nicaragua	62	6	6	--	--
Panama	150	61	68	37	13
Total^b	643	507	331	377	142
Other North America:					
Canada	13	15	19	14	11
Mexico	33	(c)	18	114	228
Total^b	46	15	37	128	239
South America:					
Argentina	219	221	163	56	38
Bolivia	52	9	19	7	7
Brazil	363	356	340	225	133
Colombia	73	58	181	128	45
Ecuador	--	19	28	19	--
Peru	90	108	100	58	30
Other ^d	58	45	11	45	18
Total^b	855	816	842	538	271
Total Western Hemisphere^b	2,087	1,964	1,740	1,388	971
EASTERN HEMISPHERE:					
Australia	217	256	134	108	75
China, Taiwan	33	35	26	21	11
Fiji Islands	35	32	--	16	25
India	30	(c)	20	(c)	7
Malagasy	16	16	12	12	7
Malawi	5	37	40	(c)	(c)
Mauritius	30	34	11	30	(c)
Mozambique	28	28	10	22	20
Philippines	262	416	347	235	146
South Africa	47	83	58	39	NA
Swaziland	40	48	18	28	28
Thailand	16	43	37	24	13
Zimbabwe	34	43	16	21	11
Other ^e	60	8	38	37	32
Total Eastern Hemisphere^b	853	1,079	767	593	375
TOTAL U.S. IMPORTS^b	2,940	3,043	2,507	1,981	1,346
TOTAL U.S. SUPPLY	8,569	8,955	8,540	8,572	8,671

^a Other 1987-with tons in ()--includes Barbados (24), Haiti (8), Jamaica (11), St. Christopher-Nevis (7), and Trinidad and Tobago (7).

^b May not add due to rounding.

^c Less than 0.5.

^d Other 1987-with tons in ()--Guyana (11), Uruguay (7).

^e Other 1987-with tons in ()--Congo (8), Ivory Coast (8), Papua New Guinea (8), and West Germany, Belgium, France, Sweden, Switzerland, United Kingdom, China, and Hong Kong all less than 0.5.

Source: USDA Sugar and Sweeteners Situation and Outlook Report, Vol. 9(1), March 1984, Vol. 10(2), July 1985; Vol. 11(1), March 1986; Vol. 12(1), March 1987; Vol 13(1), March 1988.

U.S. PER CAPITA CONSUMPTION OF ALL SWEETENERS IN POUNDS 1970 - 1987

CALORIC SWEETENERS												NON- & LOW CALORIC SWEETENERS				
Cal. Year	Refined cane and beet sugar				Corn Sweeteners ^a				Minor Caloric ^a			Total caloric ^b	Saccharin	Aspartame	Total non & low caloric ^c	Total all
	U. S.A.		Im-ported (Cane)	Total	Syrups		Dex-trose	Total	Honey	Edible syrup	Total					
	Beet	Cane			High fructose	Glu-cose										
1970	31.3	25.0	45.4	101.7	0.7	14.0	4.6	19.3	1.0	0.5	1.5	122.5	5.8	0	5.8	128.3
1971	30.6	22.9	48.6	102.1	0.9	14.9	5.0	20.8	0.9	0.5	1.4	124.3	5.1	0	5.1	129.4
1972	30.3	25.3	46.7	102.3	1.3	15.4	4.4	21.1	1.0	0.5	1.5	124.9	5.1	0	5.1	130.0
1973	30.2	24.7	45.9	100.8	2.1	16.5	4.8	23.4	0.9	0.5	1.4	125.6	5.1	0	5.1	127.8
1974	25.8	20.8	49.0	95.6	3.0	17.2	4.9	25.1	0.7	0.4	1.1	121.9	5.9	0	5.9	131.5
1975	30.1	24.6	34.4	89.2	5.0	17.5	5.0	27.5	1.0	0.4	1.4	118.1	6.1	0	6.1	124.2
1976	32.0	22.4	39.0	93.4	7.2	17.5	5.0	29.7	0.9	0.4	1.3	124.4	6.1	0	6.1	130.5
1977	29.8	22.9	41.5	94.2	9.5	17.6	4.1	31.2	1.0	0.4	1.4	126.8	6.6	0	6.6	133.4
1978	27.4	22.9	41.2	91.4	12.1	17.8	3.8	33.7	1.1	0.4	1.5	126.6	7.1	0	7.1	133.7
1979	26.5	21.1	41.7	89.3	14.9	17.9	3.6	36.4	1.0	0.4	1.4	127.1	7.4	0	7.4	134.4
1980	26.9	24.3	32.5	83.6	19.1	17.6	3.5	40.2	0.8	0.4	1.2	125.1	7.7	0	7.7	132.8
1981	25.6	21.5	32.4	79.4	23.2	17.8	3.5	44.5	0.8	0.4	1.2	122.9	8.0	0.2	8.2	131.1
1982	25.4	23.5	24.9	73.7	26.7	18.0	3.5	48.2	0.9	0.4	1.3	122.8	8.4	1.0	9.4	132.2
1983	23.1	24.0	23.9	71.1	30.7	18.0	3.5	52.2	1.0	0.4	1.4	123.8	9.5	3.5	13.0	136.8
1984	21.5	21.8	24.2	67.4	36.3	18.0	3.5	57.8	1.0	0.4	1.4	126.0	10.0	5.8	15.8	141.8
1985	22.4	24.2	16.5	63.0	45.0	18.0	3.5	66.5	1.0	0.4	1.4	131.1	6.0	12.0	18.0	149.1
1986	23.2	23.5	13.5	60.2	45.8	18.0	3.5	67.3	1.0	0.4	1.4	128.8	5.5	13.0	18.5	147.3
1987	29.3	25.4	7.5	62.2	46.3	18.0	3.5	67.8	1.0	0.4	1.4	132.4	6.0	14.0	20.0	152.4

^a Dry basis.

^b May not add precisely due to rounding.

Source: 1970-83--USDA Sugar and Sweeteners Situation and Outlook Report Vol. 9(4), December 1984; 1984-86--Vol. 12(1), March 1987; Vol. 13(1), March 1988.

^cAssumes saccharin 300 times as sweet as sugar; aspartame 200 times.

Source: USDA Sugar and Sweeteners Situation and Outlook Report: 1970-77 Vol. 4(5), May 1979; 1978-79 Vol. 10(2), July 1985; 1980-86 Vol. 12(1), March 1987; Vol. 13(1), March 1988.

^a Dry basis.

^b May not add precisely due to rounding.

Source: 1970-83--USDA Sugar and Sweeteners Situation and Outlook Report Vol. 9(4), December 1984; 1984-86--Vol. 12(1), March 1987; Vol. 13(1), March 1988.

^c Assumes saccharin 300 times as sweet as sugar; aspartame 200 times.

Source: USDA Sugar and Sweeteners Situation and Outlook Report: 1970-77 Vol. 4(5), May 1979; 1978-79 Vol. 10(2), July 1985; 1980-86 Vol. 12(1), March 1987; Vol. 13(1), March 1988.

and other feed and oil products. Nonetheless, HFCS always remains priced under sugar.

In 1986, HFCS consumption was 5.5 million tons (dry weight basis). Combined glucose and dextrose consumption was 2.6 million tons.

Twenty-five plants in 12 states produce corn syrups. HFCS is produced in 18 factories in 11 states. The seven other plants produce only glucose and/or dextrose.

Cane Sugar Refining

About three-fifths of all refined sugar consumed in the U. S. comes from sugarcane. In 1986, 3.2 million tons of domestic and 1.7 million tons of

imported raw sugar were refined in 15 U. S. refineries located in 10 states. Most U. S. cane sugar is refined in 13 refineries located in seven Gulf and East coast states. The large C&H refinery located near San Francisco handles Hawaiian raw sugar while the C&H refinery in Honolulu meets Hawaii State granulated and liquid sugar needs.

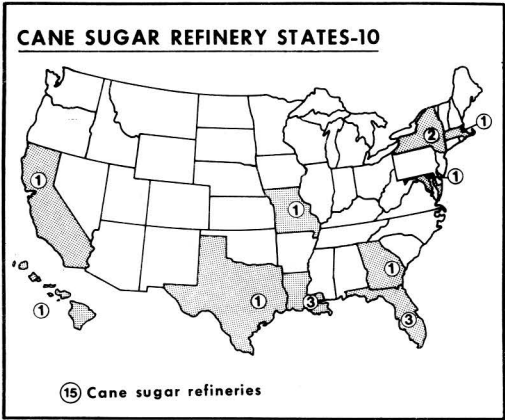
SWEETENER MARKET

The U. S. caloric sweetener market, which has undergone considerable change over the past decade, may be entering a period of relative stability with both sugar and corn sweetener growth tied to increases in the population.

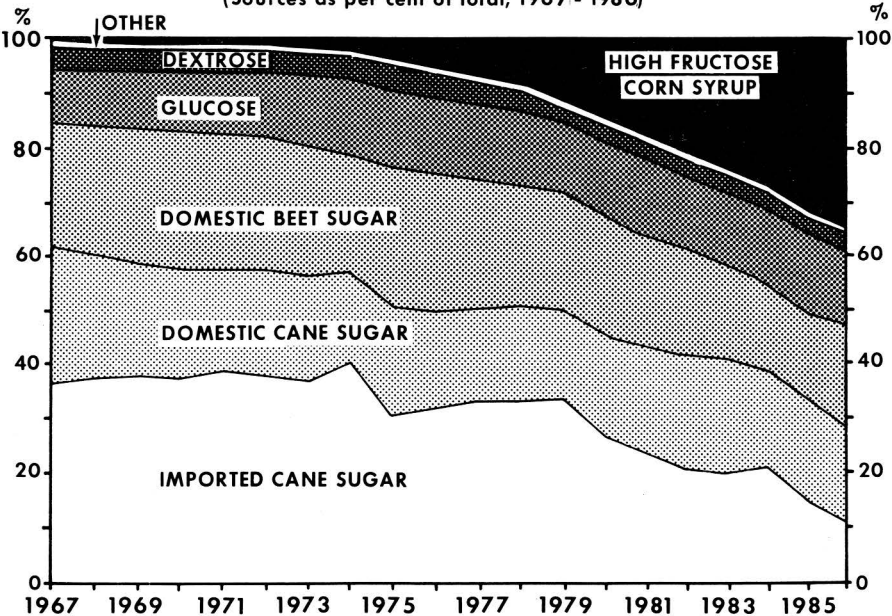
Further market gains by corn sweeteners, especially HFCS, which, on the basis of price, has taken the liquid sweetener market from sugar, appear limited under present technology.

HFCS sales, which increased 19 percent annually between 1981 and 1985, were up only 2.6 percent in 1986. Further HFCS gains are expected to be restricted by 1)—limited sugar substitution and population growth, and 2)—by additional non- and low-caloric sweetener use, particularly in soft drinks.

Saccharin use in 1986 is estimated at 5.5 pounds a person (sugar equivalent basis), down from 10.0 pounds in 1984. This was due to many soft drink bottlers switching to all-aspartame-sweetened products. Aspartame consumption in 1986 has been estimated at 13 pounds (sugar equivalent



UNITED STATES PER CAPITA CALORIC SWEETENERS CONSUMPTION
(Sources as per cent of total, 1967-1986)



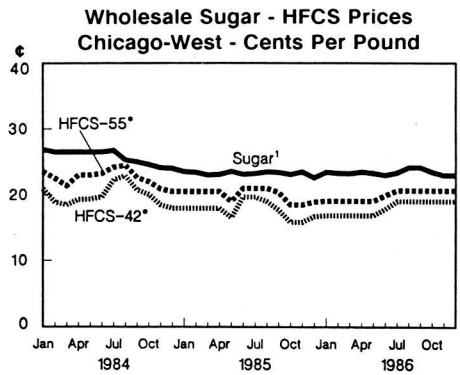
Source: 1962-1982: Based on data from USDA Sugar and Sweetener Report, Vol. 8(2), June 1983. 1983-1986: Vol. 12(1), March 1987.

basis), mostly through diet soft drinks. Further market gains of these two sweeteners appears limited to soft drinks because of technological limitations and government approvals needed for use in other products.

Total sugar deliveries declined 212,000 tons in 1986, compared with a drop of 391,000 tons in 1985. The 1986 reduction of deliveries reflects a 2.8 percent drop in industrial-use sugars (excluding beverages), and a 1.2 percent decline in non-industrial sugars. Beverage use dipped 67 tons to 267,000 tons.

U. S. raw sugar prices in 1986 averaged 20.95 cents a pound -- 0.61 cents better than in 1985 -- but still below 1984 and 1983, the latter year in which they averaged 22.04 cents a pound.

Prices began to move slightly higher in December following announcement of a 1-million-ton U. S. sugar import quota for 1987. Prices rose to 21.76 cents in February 1987, the highest level in more than two years.



A 1986 corn harvest of 8.25 billion bushels was the second largest in history. This caused lower corn prices and net corn starch costs which were reflected in lower average 1986 glucose and dextrose prices (4 and 2 percent, respectively),

U.S. SUGAR DELIVERIES TO INDUSTRIAL & NON-INDUSTRIAL USERS 1982 - 1986

1,000 Short Tons - Refined

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
<u>INDUSTRIAL USE</u>					
Food Products:					
Bakery/Cereals	1,296	1,387	1,404	1,494	1,430
Confectionery	940	1,087	1,115	1,059	1,055
Processed Foods	450	454	433	422	386
Dairy	404	385	408	456	447
Other	526	431	416	441	451
Subtotal	3,616	3,744	3,776	3,878	3,769
Beverages	1,583	1,284	908	340	267
Total Industrial	5,199	4,992	4,684	4,218	4,036
<u>NON-INDUSTRIAL USE</u>					
Institutions ^a	177	195	209	204	140
Wholesalers, Jobbers ^b	1,951	1,713	1,744	1,874	1,881
Retail Grocery	1,086	1,168	1,100	1,045	1,066
Total Non-Industrial	3,214	3,076	3,053	3,123	3,087
Total Food/Beverage Use	8,413	8,068	7,736	7,341	7,123
Other Use ^c	106	131	127	131	137
TOTAL USE	8,519	8,199	7,863	7,472	7,260
Consumer-size Packages ^d	2,310	2,314	2,274	2,305	2,293
Redistributed to industrial, other users ^e	727	567	570	614	654
TOTAL ^f	3,037	2,881	2,844	2,919	2,947

^a Includes eating, drinking places, government and military.

^b Includes sugar dealers.

^c Largely pharmaceuticals and some tobacco.

^d Less than 50 pounds.

^e Includes some institutions.

^f Equal to total of wholesalers and retail.

Source: USDA Sugar and Sweetener Situation and Outlook Report, Vol. 12(1), March 1987.

and stable HFCS-55 prices of 19.96 cents a pound (the same as 1985) in the Chicago-West market. HFCS-42 prices rose 2 percent to 18.07 cents a pound.

U. S. SUGAR LEGISLATION

Sugar in the U. S.--and elsewhere in the world--has always been under some form of government control.

A tariff on sugar to support federal government activities was the first piece of general legislation enacted by the first U. S. Congress in 1789. Tariffs on sugar imports remained an important source of government revenue until enactment of federal income and corporate taxes early in this century.

U. S. Sugar Act

From 1934 to 1974, sugar production, wages and working conditions, and other aspects of U. S. sugar, were governed by a series of laws known as the Sugar Act. This separate legislation was in contrast to omnibus farm law which encompassed other major commodity programs, also enacted during the great depression of the 1930s.

The Sugar Act also was unique in that it was self-supporting. A refiners' tax of 1/2-cent a pound supported the cost of administering the law and of compliance payments made to sugar farmers who agreed to operate under the legislation.

During the 40 years of successive sugar laws, the U. S. Treasury collected more than \$500 million above its cost of administration.

Additionally, American consumers benefited from a stable supply of sugar at reasonable prices. Only twice during the four decades of this law's life did price increases of refined sugar substantially exceed increases of the Department of Labor's annual index of all food prices at wholesale. That was in 1963 and again in 1974 when world shortages caused sugar prices--fueled by speculative buying--to rise sharply. The same index reveals sugar prices were generally above the index and more volatile between 1860 and 1934.

With defeat of the Sugar Act in 1974, the U. S. abandoned a cohesive national sugar policy until 1981. This seven year period was chaotic for American sugar producers. Excess world production, failure to achieve an effective International Sugar Agreement, and little control of subsidized sugar imports into the U. S. threatened survival of the domestic sugar industry, the nation's sixth largest farm-tonnage crop. Concurrently, high-fructose corn syrup began taking away the liquid sweetener market from sugar, intensifying price competition within a shrinking market.

U. S. Farm Act of 1981

In 1981, Congress, for the first time, included

sugar as a permanent program with other major farm commodities in national farm policy legislation--the Agriculture and Food Act of 1981--known as the Farm Act. This was in recognition of two primary concerns:

1) uncontrolled imports of foreign subsidized sugar represented unfair competition for American farmers and threatened the survival of the domestic industry.

2) the national interest could be best served by the country maintaining some self-sufficiency in sugar production as a means of providing U. S. consumers with an ample supply of sugar at reasonable prices.

Enacted by Congress and signed into law in December 1981, Title IX, the Sugar Provision of the Farm Act, provided protection for our nation's sugar producers until September 30, 1986.

The law was designed to keep efficient U. S. producers in business by protecting them from unfair competition from subsidized foreign sugar imports. No cash payments or other government grants were involved, and it was the intent of Congress that the program be administered without cost to the government.

Major elements of the program included:

A nonrecourse sugar loan program under which sugar processors of raw cane or refined beet sugar could place sugar under loan to the Commodity Credit Corporation with the sugar as full collateral for the loan.

Loan rates were set at an average of 17 cents per pound of raw sugar and for refined beet sugar at a rate "fair and reasonable" in relation to the raw cane sugar loan rate, for the 1982 crop. The loan rate increased at small annual increments to 18 cents per pound for raw sugar for the 1985 crop. A 16.75 cents per pound purchase program was included to provide temporary support until October 1, 1982.

Existing authority under Section 22 of the Agriculture Adjustment Act of 1933 to impose fees or quotas to protect the program, plus Headnote 2 authority under the Tariff Schedule of the United States also was utilized.

Food Security Act of 1985

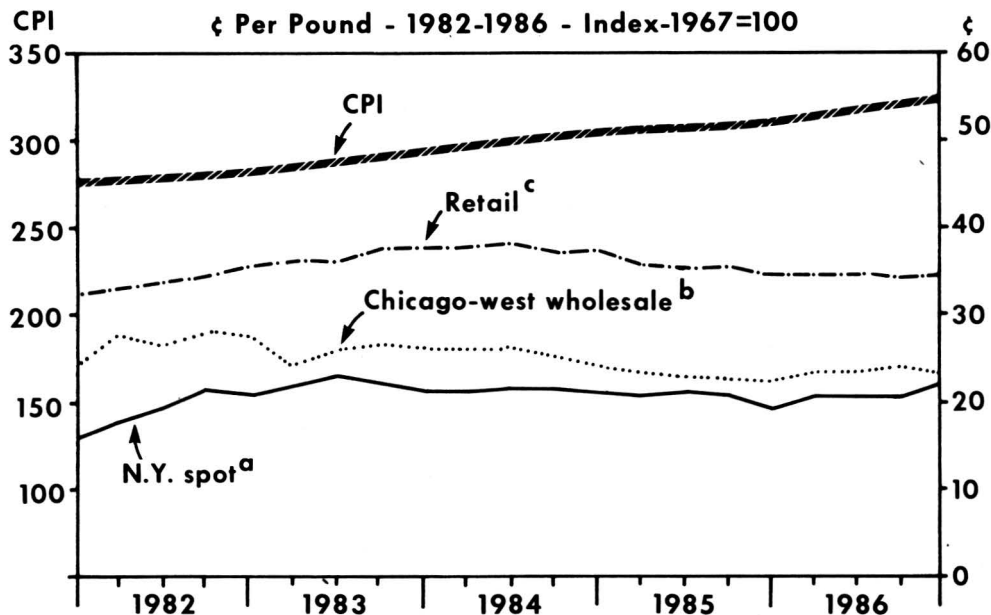
The sugar price support program in the 1981 law was extended until September 30, 1990 in the Food Security Act of 1985, with some minor changes:

The minimum loan rate was maintained at 18 cents per pound of raw sugar through the five-year life of the bill but with Administration authority to increase the loan rate annually based upon changes in the cost of sugar products, the cost of production, and other circumstances adversely affecting domestic sugar production.

Congress directed the Administration to extend

U.S. SUGAR PRICES & CONSUMER PRICE INDEX - ALL FOOD

¢ Per Pound - 1982-1986 - Index-1967=100



^a Raw sugar, C.I.F., duty-free paid, contract No. 12 to June 1985; to Dec. 1985, "nearby futures"; Jan. 1986, No. 14 contract "nearby futures."

^b Bulk prices. Starting 1983 prices are estimated, not "list."

^c U. S. retail average refined.

Sources: USDA Sugar and Sweetener Report, Vol. 12(1), March 1987; CPI - U. S. Bureau of Labor Statistics. Compiled by HSPA.

the 1985/86 quota by not less than 3 months, or to take such other steps as may be necessary to limit loan forfeitures by an equal amount. The Administration extended the current 10-month 1.85 million ton quota for 3 additional months.

For the 1987 fiscal year and beyond, Congress specified that "the President shall use all authorities . . . to enable the Secretary of Agriculture to operate the program . . . at no cost to the Federal Government."

New provisions were included protecting cane and beet farmers from nonpayment due to processor bankruptcies and from natural disasters.

Farm Act Administration

Proper administration of the sugar support program requires restrictions upon the entry of foreign source sugar to our market sufficient to make the marketplace more attractive to domestic producers than forfeiture of sugar placed under loan to the Commodity Credit Corporation (CCC). To determine the necessary price objective, the Administration developed a Market Stabilization Price (MSP), at a level equal to the loan rate plus accrued interest, transportation and handling cost, and an incentive factor.

Marketplace prices are measured by the New York Coffee and Sugar Exchange domestic spot price for raw sugar. The New York spot price

1981 & 1985 SUGAR LOANS RATE, MARKET STABILIZATION PRICE & U.S. RAW SUGAR PRICE (cents per pound)

Sugar year by quarter	Farm Act		N.Y.* price
	Loan rate	M.S.P.	
1982/83 Oct.-Sept.	17.00	20.73	21.78
1983/84 Oct.-Dec.	17.50	21.17	21.75
Jan.-March	17.50	21.17	21.80
April-June	17.50	21.17	22.03
July-Sept.	17.50	21.17	21.77
1984/85 Oct.-Dec.	17.75	21.57	21.35
Jan.-March	17.75	21.57	20.67
April-June	17.75	21.57	21.11
July-Sept.	17.75	21.57	20.44
1985/86 Oct.-Dec.	18.00	21.50	19.15
Jan.-March	18.00	21.50	20.88
April-June	18.00	21.50	20.91
July-Sept.	18.00	21.50	20.90
1986/87 Oct.-Dec.	18.00	21.78	21.12
Jan.-March	18.00	21.78	21.68
April-June	18.00	21.78	21.79 ^v
July-Sept.	18.00	21.78	
1987/88 Oct.-Dec.	18.00		
Jan.-March	18.00		

* No. 12 contract to June 1985; "nearby futures" until Jan. 1986; "nearby" No. 14 contract futures thereafter.

^v Estimated

**Market Stabilization Price
1986/87**

<u>Pricing Factors</u>	<u>Cents/Pound</u>
Loan Rate	18.00
Transportation/Handling	2.93
Interest Cost	.65
Incentive to Market	.20
TOTAL MSP	21.78

includes payment for sugar free and clear, landed at a refinery in New York City. Adjustments are made -- plus or minus -- for refineries in other parts of the nation. Thus all costs for moving the sugar from the "farm gate" to the market are for the account of the farmer.

Initially, the Administration sought to defend the program through imposition of fees and duties on sugar imports. With sharply dropping prices in early 1982 the 50 percent ad valorem fee limit under Section 22 authority and the 2.8125 cent maximum duty authority, soon made those measures insufficient, and country-by-country import quotas were established in May 1982 based upon each country's sales to the U. S. market from 1975 through 1981.

The imposition of these quotas brought prices up to, and somewhat above the MSP, where they remained until the third quarter of 1984. Since then (through February 1987) the price has remained below the MSP as a result of several factors. Excessive quotas, sugar blends, increased high sugar content product imports, illegal diversion of non-quota sugar imports from the re-export to the domestic market, earlier than anticipated switch by the major soft drink companies to high fructose corn sweetener, and underestimation of domestic sugar production all played a role in reducing prices below the MSP.

A number of actions were taken in an effort to defend the program and avoid forfeitures of sugar under loan.

In November 1984, U. S. Customs Service ruled that sugar blends would be included under quota restraints. In January 1985 the quota year was extended for an additional two months. Additionally, the President signed an executive order that month establishing quotas on certain high sugar content products. Additional actions reducing the duty to the .625 cent minimum and suspending the fee on raw sugar imports benefited the exporters of sugar to the U. S. market. Sugar loan maturity dates were extended in an effort to avoid forfeitures.

On September 13, 1985, import quotas for the 1986 fiscal year were announced at 1.85 million tons for the 10 months remaining -- some 600,000 to 800,000 tons in excess of the market's needs. This caused a sharp reduction in the price of sugar to almost 3 cents below the MSP and resulted in the forfeiture of 303,000 tons of Florida sugar to the CCC at a governmental cost

of \$107 million. This was the first and only forfeiture of sugar under the 1981 Farm Act except for sugar forfeited due to processor bankruptcy.

The excessive quota announced in September 1985 followed heavy lobbying by foreign sugar suppliers, particularly Caribbean countries.

On April 30, 1986 the Administration announced the extension of the fiscal year 1986 quota by 3 months in response to the Congressional directive. This caused the price of sugar to improve somewhat, but it lingered approximately half a cent or more below the MSP of 21.50 cents per pound throughout 1986. Meanwhile sugar loans had again been extended beyond the six-month time limit in the hope that prices would improve so as to make the marketplace once again more attractive than forfeitures to the CCC. In addition, the Administration sold 122,000 tons of forfeited sugar to an ethanol manufacturer for just over 3 cents per pound, imposing a \$36 million cost on the program. Oversight hearings were conducted by a House Government Affairs Oversight Subcommittee on the propriety of this action.

On December 15, 1986, the Administration announced a sugar import quota of 1,003 million tons for calendar 1987, a reduction of 40 percent from the prior 13-month quota. The reduction recognized lessened import needs resulting from carryover stocks, a further decline in sugar consumption, an increase in domestic sugar production (primarily beet sugar), and non-quota sugar-blend product imports.

In January 1987, the Administration, repeating its opposition to the sugar program, presented a fiscal 1988 budget program to Congress that presumed a change in the sugar provisions of the 1985 farm law, reducing the loan rate from 18 to 12 cents a pound. Legislation was subsequently introduced in April 1987.

If approved by Congress as introduced the revised program would reduce the loan rate beginning with the 1987 crop and also institute a program of direct payments, to be phased out over four years. These payments would be decoupled from current production, being calculated on the smaller of the 1985 or 1986 crops. Full payment of 6 cents a pound, declining by 1-1/2 cents per year, would be paid on the first 350 tons of sugar only, with reduced payments on additional production and no payments on production in excess of 20,000 tons.

Estimated cost of the direct payment program is put at \$1.2 billion over four years.

Domestic sweetener industry opponents contend it would destroy the bulk of the domestic sugar industry; reduce sugar revenues of debtor nations holding U. S. sugar quotas by one-third; and destroy the no-cost provisions of the current farm law.

WORLD SUGAR

Sugar is produced in about 100 nations in both temperate and tropic regions. It is one of the world's most traded food commodities as well as one of the most regulated.

Total world production in the 1985/86 sugar crop year was 98.1 million metric tons, according to the USDA.

million tons) added to large existing world stockpiles, now estimated at 46.4 million tons by the USDA. This is 22 million tons greater than world inventory needs. (The West German sugar statistical firm of F.O. Licht estimates the world stockpile at 37.4 million tons with consumption at 100.8 million tons. This difference between USDA and Licht figures is

WORLD'S 10 LARGEST PRODUCING, EXPORTING, IMPORTING & CONSUMING NATIONS 1985 - Metric Tons, Millions

Producers		Exporters		Importers		Consumers	
Country	Tons	Country	Tons	Country	Tons	Country	Tons
EEC	13.9	Cuba	7.2	USSR	4.8	USSR	13.3
USSR	8.6	EEC	4.3	USA	2.3	EEC	10.5
Brazil	8.5	Australia	2.7	China	2.2	India	9.0
Cuba	7.9	Brazil	2.6	Japan	2.0	USA	7.3
India	7.0	Thailand	1.8	India	1.8	China	6.4
USA	5.4	So. Africa	1.0	EEC	1.3	Brazil	5.8
China	5.2	Dom. Rep.	0.7	Canada	1.2	Mexico	3.6
Mexico	3.5	Philippines	0.6	So. Korea	0.9	Japan	2.9
Australia	3.4	Mauritius	0.6	Egypt	0.7	Indonesia	1.8
So. Africa	2.5	Fiji	0.4	Iran	0.6	Poland	1.7
Total	65.9		21.9		17.8		62.3

Source: International Sugar Organisation, Statistical Bulletin, Vol. 45(8), August, 1986.

Nearly 62 million tons (Note: All sugar tonnages reported in this section are in metric tons.) was produced from sugarcane and 36.4 million tons was from sugarbeets.

A total of 97.7 million tons was consumed, with the excess of production over consumption (1.0

primarily due to the manner in which USSR and China's (Mainland) stocks are computed. Nonetheless, the Licht forecast places the world's carryover stock surplus 11.7 million tons above the desirable level of 25 percent of consumption.)

WORLD SUGAR PRODUCTION, CONSUMPTION, IMPORTS & EXPORTS 1985/86

Millions, Metric Tons - Raw Value

Region	Production			Consumption	Imports	Exports
	Beet	Cane	Total			
North America	2.8	6.4	9.2	11.8	3.2	0.7
South America	0.4	12.8	13.2	10.9	0.1	3.2
Central America	0.0	1.8	1.8	0.9	--	1.0
Caribbean	0.0	8.5	8.5	11.5	0.1	7.6
European Community	14.4	0.0	14.4	11.5	3.0	6.6
Other West Europe	1.0	0.0	1.0	1.3	0.5	0.1
East Europe	5.5	0.0	5.5	6.0	1.0	0.9
U.S.S.R.	8.3	0.0	8.3	13.3	5.5	0.3
North Africa	0.5	1.4	1.9		2.1	
Other Africa	0.0	5.9	5.9	8.1	1.0	3.0
Middle East	2.0	0.3	2.3	5.2	2.8	0.1
Asia	1.5	20.9	21.4	26.1	7.8	3.3
Oceania	0.0	3.7	3.7	1.0	0.2	3.0
Total*	36.4	61.7	98.1	97.6	27.5	29.8

* Rounded

Source: FAS, ERS/USDA Agricultural Outlook, Dec. 1986.

Approximately 70 nations exported a total of 29.8 million tons to an estimated 115 countries relying on imports to meet all or part of their sugar needs. Some importing nations also export sugar, and actual net exports can range 10 to 20 percent below total reported exports.

Most world sugar producers and consumers are protected from market price fluctuations through a variety of domestic sugar programs which include import restrictions or embargoes, price supports, grower and/or export subsidies and other means in a variety of combinations.

Approximately 75 percent of world consumption occurs within the countries where the sugar was produced.

International Sugar Trade

Only about a quarter of world sugar consumption is involved in international trade. An even smaller amount -- 16 percent -- is traded at world sugar market prices. More than a fifth of the total trade is under special arrangements and at artificially high prices, like those the USSR pays Cuba (estimated as high as 50 cents a pound, raw basis). Little of the sugar traded at world sugar market prices is sold to consumers at world prices (plus shipping, processing and distribution costs). Almost all is sold to consumers on the basis of domestic policies. Japan, for example, has substantial duties and price regulation. In nations where world market sugar is available, Canada is an example, the governments provide grower supports.

For sugar traded under preferential or other type of trade agreement, the average price (1984/85) has been estimated at 21 cents a pound. In contrast, sugar traded on the world sugar market averaged just 5 cents a pound in 1984, 4 cents in 1985 and 6 cents in 1986. These average prices on the world market are only about half or less than the production costs (1984/85) of ten major sugar exporting nations.

World Sugar Market

The term "world sugar market" misleads and confuses the uninitiated, many of whom often believe it represents a competitive price for all sugar sold throughout the world. But, in fact, sugar placed in the world market is "homeless" and is sold for whatever price it might bring. Raw sugar prices quoted on the New York and London exchanges are sold FOB Caribbean, a price that includes neither shipping and insurance costs to, nor duties and fees at, the port of delivery; nor does it reflect refining and distribution costs to deliver refined sugar to the end user.

"World residual sugar market" would be a more descriptive name.

The world market's chief characteristic is price volatility, and its chief purpose is to act as the world's sugar reserve stockpile. When supplies are low, prices rise sharply, fueled by speculative trading; when high, prices are severely depressed as in recent years.

(continued on p. 25)

WORLD SUGAR PRODUCTION, CONSUMPTION & STOCKS & IMPACT ON WORLD SUGAR MARKET PRICES 1973-1986 - Raw Value

Sugar year Oct./Sept.	Metric tons production	Metric tons consumption	Stocks, metric tons			World sugar market No. 11 contract cents per lb.*
			actual	desirable ^b	surplus	
1973/74	80.0	80.0	17.3	20.0	(2.7)	9.61
1974/75	78.5	77.1	18.9	19.3	(0.4)	29.99
1975/76	81.7	79.2	21.0	19.8	11.2	20.49
1976/77	86.3	81.9	24.8	20.5	4.3	11.58
1977/78	92.7	86.2	30.0	21.6	8.4	8.11
1978/79	91.3	89.6	31.0	22.4	8.6	7.82
1979/80	84.6	89.5	24.2	22.4	1.8	9.66
1980/81	88.5	88.5	24.2	22.1	2.1	29.04
1981/82	100.6	89.4	34.0	22.4	11.6	16.93
1982/83	101.3	93.8	41.4	23.5	17.9	8.42
1983/84	96.5	95.8	42.5	24.0	18.5	8.49
1984/85	100.2	96.7	46.0	24.2	21.8	5.18
1985/86 ^c	98.1	97.6	46.4	24.4	22.0	4.04
1986/87 ^d	100.1	99.7	46.8	24.9	21.9	6.05

^a World market for surplus, "homeless" sugar, f.o.b. Caribbean.

^b Based on 25% "rule of thumb" held to be desirable.

^c Preliminary.

^d Estimate.

* Calendar year, average.

Source: Compiled by HSPA; data from USDA Sugar and Sweetener Situation and Outlook Report, Vol. 12(1), March 1987; FAS/ERS, USDA Agricultural Outlook, Dec. 1986.

SUGAR SUPPLY AND DISTRIBUTION BY COUNTRIES, 1985

(Metric Tons - Raw Value)

(To convert to Short Tons, multiply by 1.1023)

COUNTRIES	SUPPLY		DISTRIBUTION	
	Production	Imports	Consumption	Exports
NORTH AMERICA				
Canada	60,000 ^a	1,157,956	1,050,000 ^a	65,329
U.S.A.	5,415,398	2,274,669	7,289,629	364,435
TOTAL	5,475,398	3,432,625	8,339,629	429,764
EUROPE				
Albania	33,000 ^a	21,981 ^b	55,000 ^a	0
Austria	468,184	0	347,585	40,566
Bulgaria	115,000 ^a	485,000 ^b	455,000 ^a	204,666 ^c
Cyprus	0	25,191 ^b	20,000 ^a	0
Czechoslovakia	840,000 ^a	122,623	800,000 ^a	248,319
E.E.C. ^d	13,860,040	1,295,333	10,515,377	4,280,366
Finland	102,532	64,747	201,838	6,828
French Terr. ^e	0	8,465 ^b	8,000 ^a	0
German Dem. Rep.	797,972	265,022	757,370	221,705
Gibraltar	0	1,206 ^b	1,000 ^a	0
Hungary	579,045	0	517,740	43,806
Iceland	0	12,500	11,000 ^a	0
Malta	0	18,190	17,173	0
Norway	0	179,930	175,079	0
Poland	1,840,900	25,000	1,690,400	186,307
Portugal	15,000 ^a	575,000	330,000 ^a	4,176 ^c
Romania	585,000 ^a	62,564 ^b	720,000 ^a	132,630 ^c
Spain ^f	1,090,000 ^a	76,067	960,000 ^a	0
Sweden	368,658	13,822	385,544	4,510
Switzerland	138,833	174,390	287,054	326
Turkey	1,397,831	54,000 ^b	1,347,830	308,109
U.S.S.R.	8,600,000 ^a	4,476,969	13,250,000 ^a	175,109
Yugoslavia	970,000 ^a	54 ^b	900,000 ^a	15,342 ^c
TOTAL	31,801,995	7,958,054	33,752,990	5,872,765
CENTRAL AMERICA				
Bahamas	0	6,529 ^b	7,000 ^a	0
Barbados	101,414	100	13,576	77,840
Belize	109,520	0	6,380	95,530
Bermuda	0	3,185 ^b	2,200 ^a	0
Costa Rica	230,000 ^a	0	150,000 ^a	3,075 ^c
Cuba	7,889,240	0	886,782	7,209,008
Dominican Rep.	920,699	0	303,900	721,607
El Salvador	278,926	0	159,262	115,479
Guatemala	500,000 ^a	0	280,000 ^a	127,764 ^c
Haiti	50,000 ^a	18,299 ^b	62,000 ^a	0
Honduras	235,095	0	119,619	102,484
Jamaica	210,000 ^a	23,632 ^b	100,000 ^a	152,113 ^c
Mexico	3,491,559	0	3,547,541	66,194
Neth. Antilles	0	8,581 ^b	8,000 ^a	0
Nicaragua	250,000 ^a	0	155,000 ^a	36,566 ^c
Panama	160,313	0	79,034	77,737
St. Christopher-Nevis	27,455	0	2,159	25,189
Trinidad	80,000 ^a	28,418 ^b	65,000 ^a	62,046 ^c
Other C. America ^g	0	18,663 ^b	17,000 ^a	0
TOTAL	14,534,221	107,407	5,964,453	8,872,632
SOUTH AMERICA				
Argentina	1,187,761	0	973,786	157,176
Bolivia	175,000 ^a	0	189,000 ^a	16,876 ^c
Brazil	8,455,484	0	5,797,131	2,608,706
Chile	351,086	28,000 ^b	402,000	0
Colombia	1,366,893	0	1,043,644	294,934
Ecuador	300,000 ^a	0	324,000 ^a	25,398 ^c
Guyana	257,688	0	31,326	230,386
Paraguay	80,000 ^a	12,000 ^b	80,000 ^a	0
Peru	710,000 ^a	2,000 ^b	650,000 ^a	90,540 ^c
Suriname	10,000 ^a	63 ^b	15,000 ^a	0
Uruguay	90,000 ^a	2,000 ^b	100,000 ^a	4,451 ^c
Venezuela	470,000 ^a	238,000 ^b	720,000 ^a	0
TOTAL	13,453,912	282,063	10,325,887	3,428,467

SUGAR SUPPLY AND DISTRIBUTION BY COUNTRIES, 1985 (cont.)

(Metric Tons - Raw Value)

(To convert to Short Tons, multiply by 1.1023)

COUNTRIES	SUPPLY		DISTRIBUTION	
	Production	Imports	Consumption	Exports
ASIA				
Afghanistan	3,000 ^a	35,980 ^b	80,000 ^a	0
Bangladesh	94,327	72,000 ^b	230,000 ^a	0
Brunei	0	6,234 ^b	6,000 ^a	0
Burma	101,000 ^a	0	100,000 ^a	0
China	5,200,000 ^a	2,214,000 ^b	6,350,000 ^a	200,000
China (Taiwan)	689,805	0	476,315	205,570
Hong Kong	0	147,101	110,000 ^a	15,827
India	7,015,972	1,781,235	8,974,358	40,757
Indonesia	1,704,878	3,266 ^b	1,794,390	0
Iran	700,000 ^a	625,303 ^b	1,300,000 ^a	0
Iraq	0	582,806 ^b	600,000 ^a	0
Israel	0	233,227 ^b	250,000 ^a	0
Japan	927,852	1,986,404	2,891,377	3,804
Jordan	0	95,000 ^b	135,000 ^a	0
Kampuchea	0	5,000 ^a	5,000 ^a	0
Korea, D.P.R.	0	120,000 ^a	120,000 ^a	0
Korea, Rep. of	0	858,133	515,603	336,199
Kuwait	0	52,024 ^b	70,000 ^a	2,023 ^c
Lao, D.P.R.	0	6,000 ^a	6,000 ^a	0
Lebanon	0	54,290 ^b	60,000 ^a	0
Macao	0	3,000 ^a	3,000 ^a	20
Malaysia	70,000 ^a	619,039	600,000 ^a	93,203
Maldives	0	5,723 ^b	5,500 ^a	0
Mongolia	0	42,128 ^b	42,000 ^a	0
Nepal	28,000 ^a	10,023 ^b	35,000 ^a	0
Pakistan	1,450,000 ^a	27,000 ^b	1,400,000 ^a	0
Persian Gulf	0	103,542 ^b	125,000 ^a	0
Philippines	1,664,845	0	1,339,825	594,845
Saudi Arabia	0	259,000 ^b	400,000 ^a	0
Singapore	0	146,114	130,000 ^a	3,409
Sri Lanka	17,000 ^a	380,066 ^b	320,000 ^a	0
Syria	50,000	357,303	385,000	0
Thailand	2,392,763	0	721,468	1,781,004
Vietnam, S.R.	184,000 ^a	14,018 ^b	211,000 ^a	16,043 ^c
Yemen Arab Rep.	0	206,000 ^b	200,000 ^a	0
Yemen Dem. Rep..	0	64,000 ^b	80,000 ^a	0
TOTAL	22,293,442	11,116,595	30,071,836	3,292,704
AFRICA				
Algeria	0	531,900 ^b	600,000 ^a	0
Angola	50,000 ^a	52,000 ^b	100,000 ^a	0
Benin	5,000 ^a	29,100 ^b	30,000 ^a	0
Botswana	0	40,647	37,000 ^a	0
Burkina Faso	10,000 ^a	28,491 ^b	35,000 ^a	0
Burundi	0	9,190 ^b	7,000 ^a	0
Cameroon, U.R.	70,000 ^a	6,339	75,000 ^a	205
Cape Verde	0	8,022 ^b	9,000 ^a	0
Cent. Afri. Rep.	0	8,892 ^b	5,000 ^a	0
Chad	8,000 ^a	21,703 ^b	30,000 ^a	0
Comoros	0	3,000 ^a	3,000 ^a	0
Congo	25,000 ^a	19,321 ^b	20,000 ^a	24,454 ^c
Djibouti	0	29,930 ^b	8,000 ^a	30,000 ^a
Egypt, Arab Rep.	900,000 ^a	711,000 ^a	1,600,000 ^a	0
Ethiopia	191,252	0	144,167	26,865
Gabon	12,000 ^a	1,195 ^b	15,000 ^a	5,000 ^a
Gambia	0	60,647 ^b	30,000 ^a	30,000
Ghana	0	34,050 ^b	30,000 ^a	0
Guinea	5,000 ^a	36,130 ^b	35,000 ^a	0
Guinea Bissau	0	2,778 ^b	3,000 ^a	0
Ivory Coast	125,000	32,448 ^b	125,000	22,210
Kenya	370,000 ^a	68,000 ^b	400,000 ^a	0
Liberia	3,000 ^a	10,400 ^b	10,000 ^a	0
Libya	0	226,000 ^b	150,000 ^a	0
Madagascar	99,017	11,847	83,550	34,925
Malawi	154,455	0	61,694	142,588
Mali	20,987	26,534 ^b	40,000 ^a	0
Mauritania	0	23,290 ^b	25,000 ^a	0
Mauritius	683,576	0	38,889	571,190
Morocco	433,131	243,477	707,037	0

SUGAR SUPPLY AND DISTRIBUTION BY COUNTRIES, 1985 (cont.)

(Metric Tons - Raw Value)

(To convert to Short Tons, multiply by 1.1023)

COUNTRIES	SUPPLY		DISTRIBUTION	
	Production	Imports	Consumption	Exports
AFRICA (Continued)				
Mozambique	60,000 ^a	30,000 ^b	90,000 ^a	9,955 ^c
Niger	0	31,504 ^b	15,000 ^a	0
Nigeria	50,000 ^a	518,000 ^b	550,000 ^a	0
Rwanda	2,000 ^a	17,700	9,500	0
Senegal	65,000 ^a	1,147 ^b	75,000 ^a	0
Sierra Leone	5,000 ^a	14,465 ^b	18,000 ^a	0
Somalia	54,000 ^a	28,000 ^b	90,000 ^a	0
South Africa	2,540,377	28,767	1,367,612	1,025,226
Sudan	450,000 ^a	11,576 ^b	470,000 ^a	0
Swaziland	395,884	0	22,434	379,874
Tanzania, U.R.	105,000 ^a	21,624 ^b	126,000 ^a	11,684 ^c
Togo	0	51,557 ^b	50,000 ^a	0
Tunisia	16,981	191,695	211,908	4,331
Uganda	34,000 ^a	884 ^b	35,000 ^a	0
Zaire	65,000 ^a	30,429 ^b	85,000 ^a	0
Zambia	143,182	0	112,911	9,089
Zimbabwe	455,643	8,046	224,661	219,587
Other Africa ^h	0	3,551 ^b	3,500 ^a	0
TOTAL	7,607,485	3,265,276	8,013,863	2,547,183
OCEANIA				
Australia	3,438,516	0	764,398	2,651,424
Fiji	366,717	380	35,723	419,143
New Zealand	0	174,000 ^b	170,000 ^a	0
Papua New Guinea	30,050	679 ^b	26,620	11,383 ^c
Western Samoa	2,500 ^a	346 ^b	3,000 ^a	0
Other Oceania ⁱ	0	12,778 ^b	12,000 ^a	0
TOTAL	3,837,785	188,183	1,011,741	3,081,950
WORLD TOTAL	99,004,236	26,350,567	97,480,399	27,525,465

^a Estimated.

^b As reported by countries of origin.

^c As reported by countries of destination.

^d European Economic Community--Belgium, Denmark, France (Metropolitan, Guadeloupe, Martinique, Reunion, French Guiana), Federal Republic of Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, and United Kingdom.

^e Including St. Pierre & Miquelon, New Caledonia and French Polynesia.

^f Peninsula and Balearic Islands only.

^g Including Leeward and Windward Islands.

^h Including Equatorial Guinea, St. Helena, Sao Tome and Sycshelles.

ⁱ Including Pacific Islands.

Sources: International Sugar Organisation, Statistical Bulletin, Vol. 45(8), August, 1986.

It is only when stocks in this residual market are at about 25 percent of world consumption that prices then begin to reflect the average cost of sugar production.

World Sugar Surplus

World production has climbed substantially in recent years; in part because of population growth and increasing demand in developing countries, but also because world shortages--an actual one in 1974/75 and a phantom shortage in 1980/81--increased prices to levels encouraging added production capacity in many nations.

As a consequence, world production has been excessive, with stocks climbing to 47.5 percent of total consumption in 1985/86.

A significant contributor to this price-depressing excess has been the EEC, which up to the mid-

1970s was a net importer of sugar. Sugar production by the then 10-member EEC has been encouraged by its common agricultural policy (CAP), which provides price supports, import controls and export subsidies. Currently, the EEC is the world's largest sugar producer and the second largest sugar exporter. Also benefitting from the CAP are sugar producers in Lome Convention countries because Lome sugar is imported and paid for at prices related to internal EEC prices. Reform of the CAP thus far has been successfully resisted by EEC farm blocs.

But the EEC is only one example of trade decisions that are political in nature and maintain excess world production. Some examples in other countries: Thailand (where domestic prices, production, and revenue sharing between producers and millers is controlled); Australia

(where protection includes an import embargo, controlled prices, and a system for pooling proceeds from higher priced domestic and contract sales with lower priced government-supported export sales); Japan (where levies on sugar imports are used to subsidize high-cost domestic producers); and Brazil (where a government agency sets prices and is the sole export agent). The U. S. program is discussed in the previous section.

Because of the extent and variety of sugar support programs and because of the relatively small amount of sugar traded on world residual market, no substantial reduction of production and accompanying improvement in price is seen for the near term.

Thus, governments are expected to maintain producer support programs.

International Sugar Agreement

Balancing world supply with demand—which suggests a reasonable return on the investment required for sugar production—has been a long sought, but elusive goal for many years.

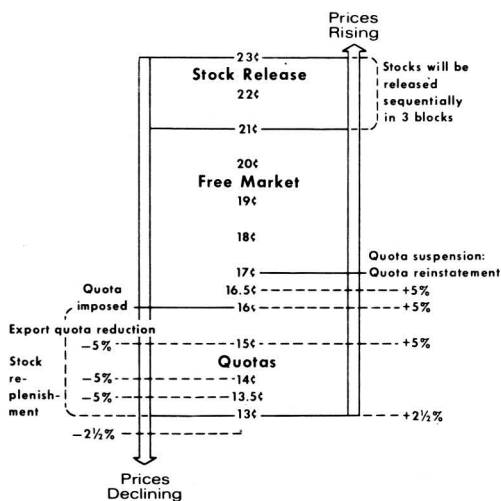
The most recent attempt was through the International Sugar Organisation. After meetings held in 1976 and 1977, the ISO forged the latest (and to date the last) International Sugar Agreement (ISA). It became provisionally effective January 1, 1978 and ran through 1984, a term that included two years of extension.

Most, but not all, major sugar exporting and importing nations were party to the ISA. Later events were to underscore the need to have every major exporting and importing nation participate.

The objective of the ISA was to maintain world market prices within a specified price corridor—originally 11- to 19-cents a pound for raw sugar, later increased to 13- to 21-cents a pound. An International Sugar Council assigned each member-producing nation an export quota and monitored the market. When prices moved too high, sugar stocks were to be released to moderate prices; when too low, export quotas were to be reduced to lower available supplies.

The ISA's first real test came after the phantom shortage of 1980/81, and it was not effective. A primary cause of this failure was lack of EEC membership. The EEC, a net importer up to the

INTERNATIONAL SUGAR AGREEMENT PRICE STABILIZATION MECHANISM 1/1/78 - 12/31/84



mid-1970s, had in the intervening years become a major world exporter with no restraints on exports to the world residual market.

During the final two years of the ISA, extensive negotiations were conducted to renew it and include the EEC. But major differences between the EEC and other major exporting nations doomed the discussions to failure and the ISA died at the end of 1984. These differences continue, and the ISO has since been maintained as a statistical service with an eventual goal of establishing a new international sugar agreement.

Sugar & GATT

The international sugar problem may be approached from another direction. In September 1986, nations signatory to the General Agreement on Tariffs and Trade (GATT) meeting at Punta del Este, Uruguay, agreed to include sugar for the first time on the agenda of trade talks by the 92-nation organization. GATT issues to be covered in the new round of negotiations are to be identified in 1987 and bargaining on them is to begin in 1988. Whether sugar will be among issues included in the 1988 talks was unknown in the spring of 1987.

GLOSSARY

- BAGASSE:** Fibrous residue remaining after sugarcane has been milled to extract the sugar-containing juices.
- BLACKSTRAP MOLASSES:** The final product remaining after all the commercially recoverable sucrose has been removed from the juices expressed from cane. It is a dark colored, heavy, viscous liquid.
- BRIX:** The measure of density of a solution containing sucrose as determined by a hydrometer.
- CALORIE:** Unit expressing the energy-producing value of food. A pound of sugar contains 1,790 calories. A standard teaspoon contains 16.
- DEXTROSE:** A widely occurring crystallizable, simple sugar which contains 6 carbon atoms in contrast to the 12 found in sucrose. It is obtained in commercial quantities by the action of acid on cornstarch. It is less sweet than sucrose.
- FRUCTOSE:** An alternate chemical name for levulose.
- GLUCOSE:** (1) An alternate chemical name for dextrose. (2) A name given to corn syrups which are obtained by the action of acids and/or enzymes on cornstarch. Commercial corn syrups are nearly colorless and very viscous. They consist principally of dextrose and small amounts of maltose, combined with gummy organic materials known as dextrins, in water solution.
- GUR:** Cane juice, concentrated nearly to dryness by boiling over an open fire, without centrifuging and with no purification other than by skimming. This ancient process is still used for producing a large share of the sugar consumed in India and some other countries. The crude product is high in glucose and correspondingly low in sucrose.
- HIGH FRUCTOSE CORN SYRUP:** High fructose corn syrups (HFCS) are produced by the enzymatic conversion of a portion of the glucose in corn syrup to fructose. Composition of presently available products ranges from 7 to 55% glucose and 42 to 90% fructose on dry solids, the balance being other saccharides. Dry solids average about 71% on total weight. The product is roughly comparable to invert syrup made from sucrose in terms of sweetness and physical properties.
- HIGH TEST MOLASSES:** A concentrated, clarified cane juice which has been inverted (usually about 2/3) to prevent sucrose from crystallizing at the high concentrations normally employed.
- INVERT OR INVERT SUGAR:** The mixture of equal parts of dextrose and levulose produced by the action of acid or enzymes on solutions of sucrose.
- LEVULOSE:** A highly soluble, simple sugar, also containing 6 carbon atoms, it is crystallized with great difficulty, is generally considered sweeter than sucrose, and is present in considerable quantities in combination with dextrose and sucrose in invert sugars.
- LIQUID SUGAR:** A concentrated solution of refined sucrose or of a mixture of sucrose and invert sugar.
- MASSECUITE:** A dense mass of sugar crystals mixed with mother liquor, obtained by evaporation.
- MOLASSES:** The mother liquor separated from sugar crystals in massecuite.
- NON-CENTRIFUGAL SUGARS:** Crude sugars made from the sugarcane juice by evaporation and draining off the molasses. Among local names are "muscovado," "panocha," and "papelon."
- PLANT CROP:** The sugarcane crop started with seed pieces (setts).
- POLARIZATION:** The amount of sucrose (sugar) contained in a solution as determined by an optical instrument--either a saccharimeter or polariscope, both of which use polarized light.
- RATOON:** Second and subsequent crops grown from the root systems of previous plantings of sugarcane. Usually one or more ratoon crops are harvested before the fields are plowed and replanted.
- RAW SUGAR:** The impure centrifugal sugar of commerce, a light brown crystalline material, generally containing between 96 and 99% sucrose, plus various impurities and moisture. Other names are "panocha" and "demerara."
- SOFT SUGARS:** Highly refined, dark-colored, molasses-flavored sugars which are frequently called brown sugars. They contain significant amounts of reducing sugars.
- SUCROSE:** Commonly known as sugar, a sweet crystallizable, colorless substance which constitutes the "sugar" of commerce. Refined cane and beet sugar is essentially 100% sucrose.
- SYRUP:** Concentrated clarified cane juice before crystallization.
- TEL QUEL:** Literally, such as (it is). When used describing sugar it means "as made," hence of a polarization usually varying among mills and producing areas.
- TURBINADO:** Direct consumption raw sugar of high polarization which must be dried in a granulator to a very low moisture content.

